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CIVIL ENGINEERING

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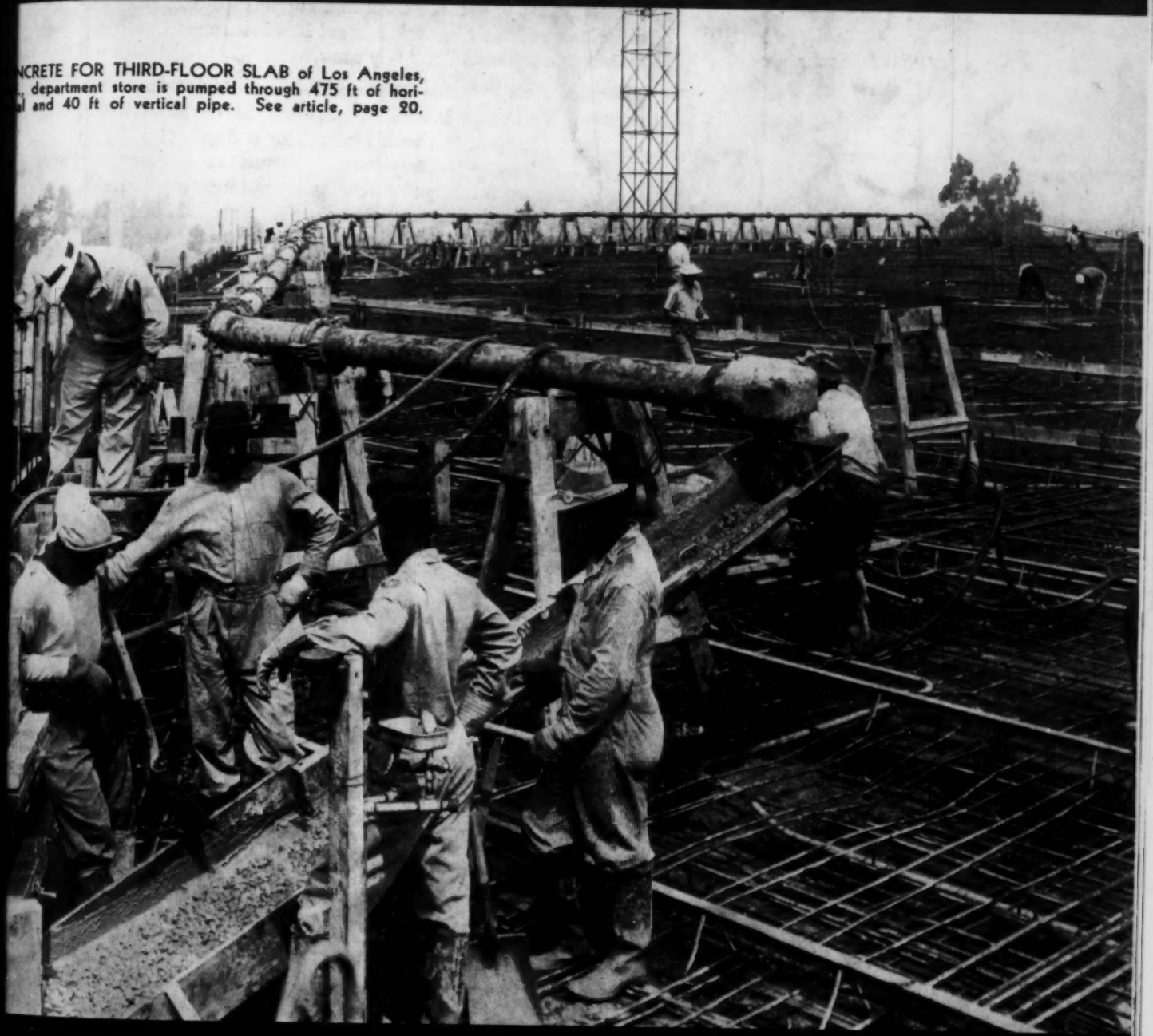


NCRETE FOR THIRD-FLOOR SLAB of Los Angeles, department store is pumped through 475 ft of hori- and 40 ft of vertical pipe. See article, page 20.

Chain of Rocks Plan Calls for 27,700,000 Cu Yd of Excavation

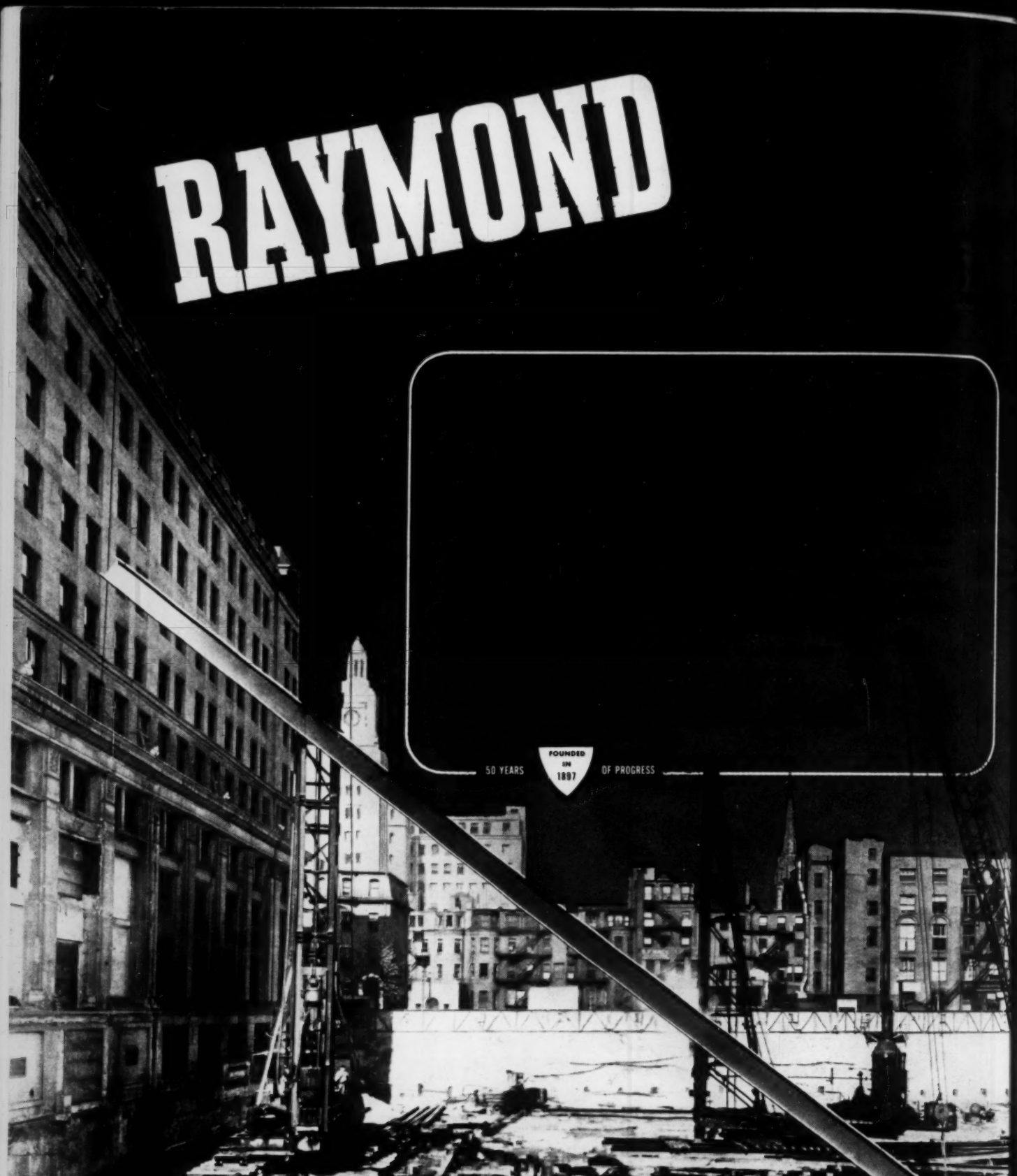
Four Earthfill Dams Create Storage Reservoir in Colorado

Modern Power and Irrigation Structures Promote Development of North Africa

Tests Assure Adequate Warning of Marine Borer Attacks in New York Harbor

SUMMER CONVENTION
DULUTH, MINN.
JULY 16-18, 1947

RAYMOND



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JUNE 1947
Volume 17 Number 6

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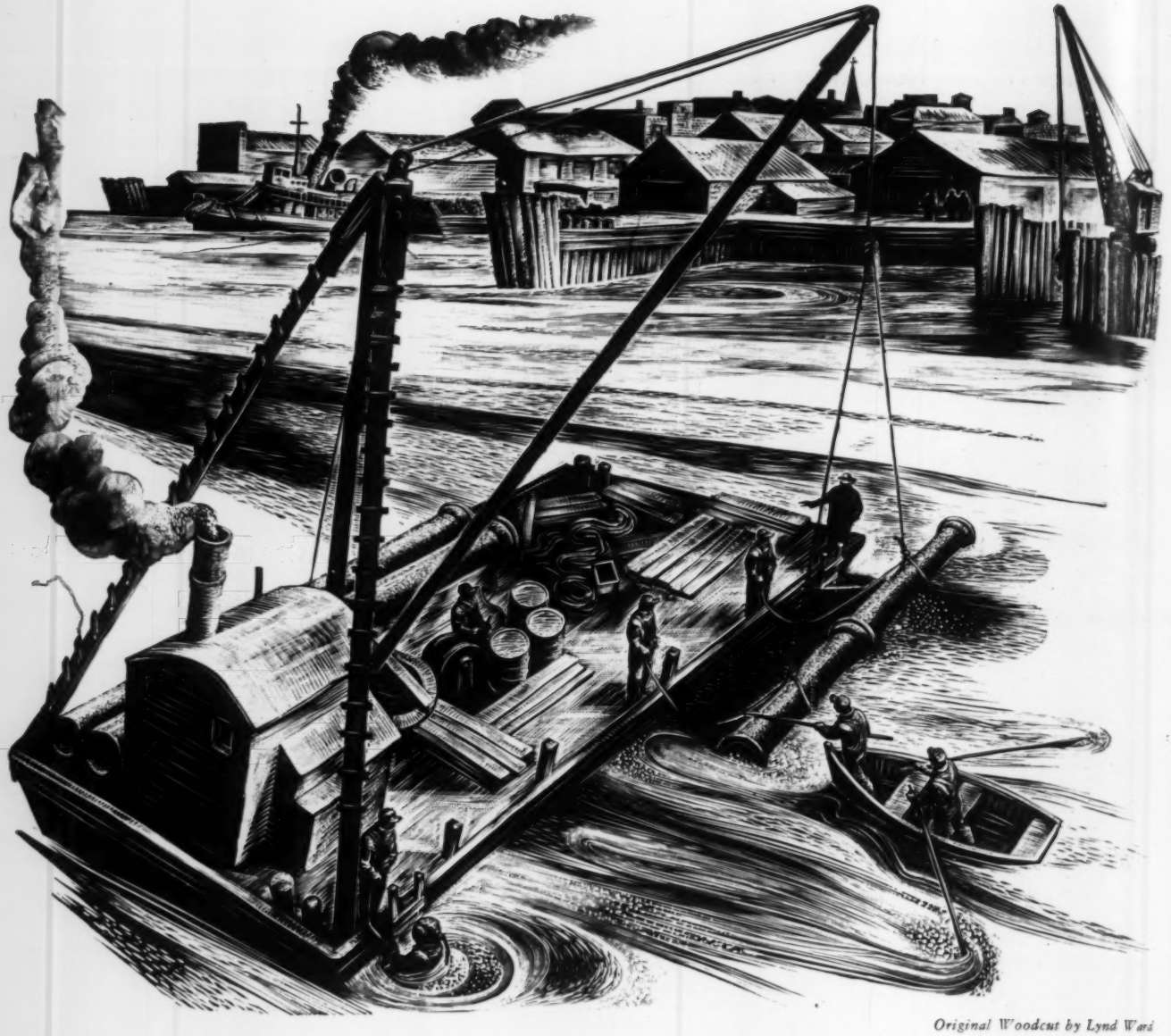

Original Woodcut by Lynd Ward

Underwater installations, for which large quantities of cast iron pipe have been used through the years, frequently present special and sometimes difficult problems. Pipe design or installation methods, or both, may be involved. If you have such a problem, we shall be glad to share our extensive knowledge of how others have met similar conditions—an experience acquired in nearly fifty years of supplying U. S. Cast Iron Pipe for river-crossings and other subaqueous jobs.

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Summer Convention to Be Held in Duluth, Minn., July 16-18, 1947

Meeting Headquarters Will Be Hotel Duluth

General Meeting—Wednesday Morning

PLANS FOR the Seventy-fifth Annual Convention to be held in Duluth, Minn., July 16–18, 1947, are rapidly being completed. The time and the location make it possible for members to combine attendance at a meeting of wide technical appeal with a vacation in a state noted for its many attractions for summer visitors. While Minnesota's great iron deposits are well known, the state has widely varied natural resources and a rapidly developing wealth. The state's shipping by both rail and water is tremendous, and the Great Lakes, with Duluth advantageously located as a port, provide a waterway to the Atlantic. An ideal summer climate and its famous 10,000 lakes make Minnesota one of the outstanding vacation spots of the country.

Following is a summary of the program as developed to date.

8:30 Registration

10:00 Annual Convention called to order by

A. C. JOSEPHS, M. ASCE, President, Duluth Section, ASCE.

10:05 Address of Welcome

HON. GEORGE W. JOHNSON, Mayor of Duluth.

10:15 Response

E. M. HASTINGS, President, American Society of Civil Engineers.

10:20 Annual Address

E. M. HASTINGS, President, American Society of Civil Engineers.

11:00 Iron Resources of Minnesota

DEAN E. H. COMSTOCK (Ret.), University of Minnesota.

11:20 Timber Resources of Northern Minnesota

GALEN W. PIKE, Forest Supervisor, Superior National Forest, Duluth, Minn.

11:40 Business Meeting

11:50 Recess for Luncheon

12:15 Men's Luncheon

Joint with Duluth Engineers Club, Association of Professional Engineers, and Northern Minnesota Engineers Society.

Hotel Duluth — Ballroom — Tickets $1.75 each.

Address by S. L. STOLTE, Past-President, Minnesota Federation of Engineering Societies, "Professionalism in Engineering."

12:15 Ladies Luncheon

At Northland Country Club followed by sightseeing, cards or golf. Tickets $1.75 each.

Technical Division Sessions—Wednesday Afternoon

Construction Division

Kirby Smith, Chairman, Construction Division Executive Committee, Presiding

2:00 Construction Features of the Maine Turnpike

R. N. BERGENDOFF, M. ASCE, Consulting Engineer, Kansas City, Mo.

2:45 The Garrison Dam Project

W. W. WANAMAKER, M. ASCE, Colonel, Corps of Engineers, U.S.A., Fort Lincoln, N.Dak.

3:30 Construction in South America

J. J. COLLINS, Assoc. M. ASCE, Raymond Concrete Pile Co., New York, N.Y.

Power Division

Joel D. Justin, Chairman, Power Division Executive Committee, Presiding

2:00 Maintenance of Concrete in Hydraulic Structures

A. C. GIESECKE, Assoc. M. ASCE, Hydraulic Engineer, Minnesota Light and Power Co., Duluth, Minn.

Waterways Division

W. W. DeBerard, Chairman, Waterways Division Executive Committee, Presiding

2:00 Wisconsin–Fox Rivers Diversion Plan

M. W. TORKELSON, M. ASCE, Director of Regional Planning, State Planning Board, Madison, Wis.

2:30 Discussion opened by

F. N. MENEFEE, M. ASCE, Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Mich.

3:00 Part Played by the Great Lakes Transportation System in World War II

DABNEY O. ELLIOTT, M. ASCE, Colonel, Corps of Engineers, U.S.A.; Great Lakes District Engineer, Chicago, Ill.

3:30 Discussion opened by

LOUIS C. SABIN, Hon. M. ASCE, Vice-President, Lake Carriers Association, Cleveland, Ohio.

WEDNESDAY EVENING July 16, 1947

7:30 Informal Dinner, Entertainment and Dance—Hotel Duluth Ballroom

After the Dinner, there will be an address by Margaret Culkin Banning, followed by motion pictures and dancing.

Tickets $5.00 each.

TERRACED SIDES OF world's largest open-pit iron-ore mine show effect of war's demand for iron ore. Hull-Rust mine at Hibbing, Minn., operated by Oliver Iron Mining Co., is objective of inspection trip during Duluth Meeting. Mine produced 20,000,000 tons of ore in 1944, and total of 361,000,000 tons since first opened in 1896

Technical Division Sessions—All Day Thursday

THURSDAY—JULY 17—MORNING

Construction Division

Kirby Smith, Chairman, Executive Committee, Construction Division, Presiding

9:00 The Future Outlook for the Construction Industry

FORREST W. PARROTT, President, Associated General Contractors of America, Inc., Vice-President, C. F. Lytle Co., Sioux City, Iowa.

9:30 Discussion

9:45 Cost Control for Construction Projects

ARNOLD O. BABB, Assoc. M. ASCE, Head of Progress Control Section, U.S. Bureau of Reclamation, Washington, D.C.

10:30 The Building Construction Research Advisory Board

J. C. STEVENS, Past-President, ASCE, Consulting Engineer, Portland, Ore.

11:00 Discussion

RICHARD H. TATLOW III, M. ASCE, Abbott, Merkt & Co., Inc., New York N.Y.

Highway Division

Charles M. Upham, Chairman, Executive Committee, Highway Division, Presiding

9:00 Program and Progress of 3-Year Plan of Highway Construction in the Northwest Area

S. L. TAYLOR, M. ASCE, U.S. Public Roads Administration, St. Paul, Minn.

9:45 Alaska Perma-Frost Investigation

H. J. MANGER, U.S. Engineer Office, St. Paul, Minn.

10:30 Soil Stabilization for Highways in Northern Minnesota

GEORGE W. DEIBLER, Assoc. M. ASCE, Highway Engineer, St. Louis County, Duluth, Minn.

11:15 The Dynamics of Highway Bridges

J. A. WISE, M. ASCE, Professor of Civil Engineering, University of Minnesota, Minneapolis, Minn.

Hydraulics Division

Lorenz G. Straub, Member, Hydraulics Division Executive Committee, Presiding

9:00 Diffusion of Submerged Jets

HUNTER ROUSE, M. ASCE, Director of Hydraulic Research, University of Iowa, Iowa City, Iowa.

9:45 An Engineering Concept of Flow in Pipes

CHARLES W. HARRIS, M. ASCE, Professor of Civil Engineering, University of Washington, Seattle, Wash.

10:15 Entrainment of Air in Water Flowing at High Velocities

LORENZ G. STRAUB, M. ASCE and WARREN W. DE LAPP, Jun. ASCE, St. Anthony Falls Hydraulic Laboratory, Univ. of Minnesota, Minneapolis, Minn.

Waterways Division

W. W. DeBerard, Chairman, Waterways Division Executive Committee, Presiding

9:00 Developments of the Missouri River Basin

DELBERT B. FREEMAN, M. ASCE, Lt. Colonel, Corps of Engineers, U.S.A.; District Engineer, Omaha, Nebr.

9:30 Discussion

9:45 Duluth-Superior Harbor

H. R. COLE, Colonel, Corps of Engineers, U.S.A.; District Engineer, Duluth, Minn.

10:15 Discussion

THURSDAY LUNCHEONS

11:15 Ladies will depart from the Hotel Duluth to the Flame for Luncheon

Following luncheon, the ladies will have a choice of sightseeing trips, including a boat trip through the Duluth-Superior Harbor. Tickets for the luncheon and afternoon's entertainment are $1.75 each.

12:15 Luncheon for Men

Duluth Hotel Ballroom. Tickets $1.75 each.

Following the luncheon there will be an address on "Minnesota's Peat Resources" by Robert L. Fitzgerald, Vice-President and General Manager, Duluth Steam Corp.

THURSDAY AFTERNOON—JULY 17

Hydraulics Division

Lorenz G. Straub, Member, Hydraulics Division Executive Committee, Presiding

SYMPOSIUM ON DESIGN AND OPERATION OF MULTIPLE-PURPOSE RESERVOIRS

2:00 Influence of State Governments on Design of Federal Multiple-Purpose Projects

DON MCBRIDE, Secretary-Manager, National Reclamation Association, Washington, D.C.

2:30 Discussion

2:45 Coordination of Operation of Multiple-Purpose Reservoirs with Public Utility Systems

J. B. THOMAS, President of Texas Electric Service Co., Fort Worth, Tex.

3:15 Discussion

3:30 Review of Principles of Design and Operation of Multiple-Purpose Reservoirs

RAYMOND A. HILL, M. ASCE Chairman of Joint Committee on Design and Operation of Multiple-Purpose Reservoirs.

Structural Division

Craig P. Hazelet, Member, Structural Division Executive Committee, Presiding

2:00 Wood as an Engineering Material

L. J. MARQUARDT, Assistant Director, U.S. Forest Products Laboratory, Madison, Wis.

2:45 Discussion

3:15 Use of Aluminum Alloys in Structures

B. J. FLETCHER, Assoc. M. ASCE, Chief Engineer, Development Division, Aluminum Co. of America, New Kensington, Pa.

4:00 Discussion

Sanitary Engineering Division

George J. Schroepfer, Past Member, Sanitary Engineering Division Executive Committee, Presiding

2:00 The Minnesota Pollution Control Act and Administration

HARVEY G. ROGERS, Assoc. M. ASCE, State Board of Health, Minneapolis, Minn.

2:30 Discussion

2:45 Proposed Sewage Treatment Plant for Rochester, Minn.

A. J. DUVALL, M. ASCE, Consulting Engineer, St. Paul, Minn.

3:15 Discussion

3:30 The Water Supply of the City of Duluth

M. D. LUBRATOVICH, Assistant Manager, Water, Gas and Sewage Disposal Department, Duluth, Minn.

THURSDAY EVENING—JULY 17

7:30 Informal Dinner and Entertainment

Music by Duluth Symphony Orchestra. Tickets $5.00 each.

ALL-DAY EXCURSION ON FRIDAY

7:30 Excursion to Iron Mines

Members, ladies and guests will leave the Hotel Duluth at 7:30 by bus for an inspection of the famed open-pit iron mines. The party will have luncheon at Hibbing, Minn., after which the Hull-Rust mine at Hibbing will be visited. School facilities and other mines in the vicinity will also be inspected.

Make Hotel Reservations Early

On account of the crowded hotel situation, members are urged to make their hotel reservations well in advance of the convention by writing to John L. Pickles, Chairman, Hotel and Registration Committee, c/o Chamber of Commerce, Medical Arts Building, Duluth 2, Minn.

Hotel Rates

	Single Room		Double Room	
	With Bath	Without Bath	With Bath	Without Bath
Hotel Duluth	4.00	2.50	6.00	4.00
Hotel Spalding	..	..	7.00	5.00
Hotel Holland	..	2.25	6.00	4.50
Hotel Lennox	4.00	2.50	6.00	4.50
Hotel Lincoln	..	3.00	5.00	3.75
Hotel Arrowhead	4.00	3.00	4.00	2.50
Hotel Cascade	4.00	3.00	4.00	2.50
Hotel McKay	3.50	2.00	4.50	3.50

Local Committee

Entertainment features and technical program are under the direction of a local committee. The executive committee for this group is made up of the chairmen of the various subcommittees, and is under the chairmanship of Gordon H. Butler. The subcommittee chairmen are as follows:

Entertainment and Reception Committee
A. C. Josephs, President, Duluth Section

Finance Committee
A. C. Giesecke

Program Committee
W. A. Clark

Publicity and Students Committee
Joseph Vernath

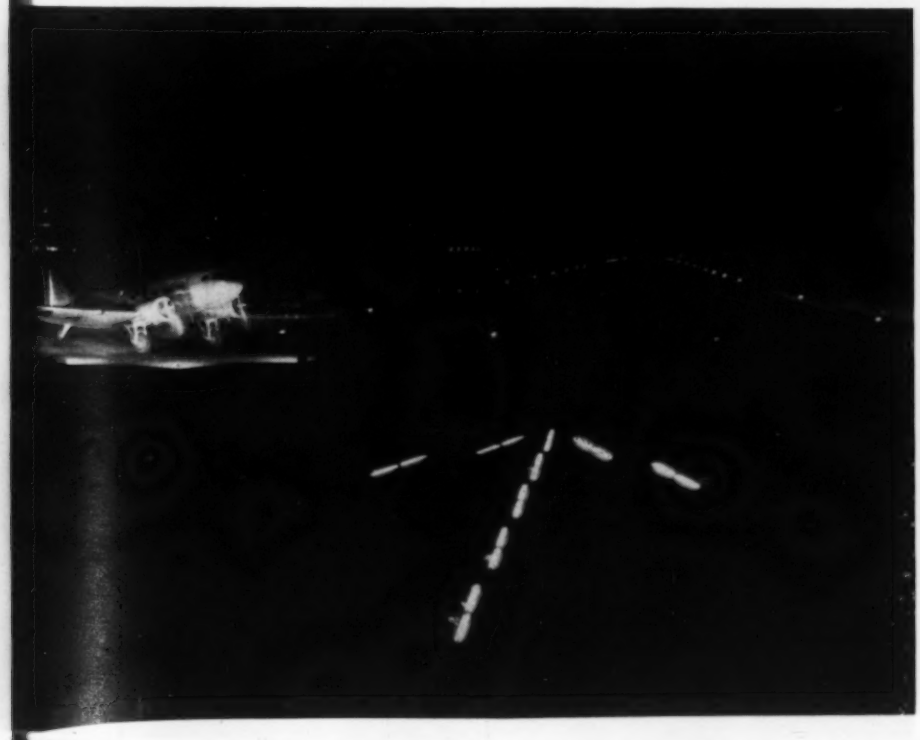
Transportation Committee
George W. Deibler

Ladies Committee
Mrs. H. E. Farnam

All-Weather Approach Provides Greater Airport Safety

THE FIRST FULL SYSTEM of an airport approach lighting system designed to penetrate 1,000 ft of thickest fog is to be installed at New York's Idlewild Airport shortly. Tests of a partial installation at the Cleveland Municipal Airport have proved the effectiveness of the system which, according to statements issued by Westinghouse Electric Corp., should sharply reduce the number of plane crashes caused by poor visibility and do away with flight cancellations. The system includes three component parts: approach lights, runway designator, and runway lights.

NEW LIGHTING SYSTEM supplements but does not replace radio and radar aids. Pilot locates airport by radio and aligns plane by instruments at outer marker—2 miles from end of runway—then begins to descend slowly until he reaches approach portal, imaginary frame 400 ft high by 700 ft wide with its lower edge 100 ft above level of runway. Here pilot receives radio signal indicating he must leave instruments and search for visual contact. When plane enters approach portal 3,500 ft from end of runway, pilot will see artificial lightning flash produced by line of brilliant approach lights, regardless of weather conditions.



PART OF APPROACH LINE, this 3,300,000,000 candlepower krypton light penetrates 1,000 ft of densest fog. Although light source is only about 2 in. long, brilliance of beam concentrated by reflector is greater than that of sun. Group of neon lights aid krypton units in piercing fog.

Chain of Rocks Project Improves Navigation on Mississippi River

Plan Calls for 27,700,000 Cu Yd of Excavation for 8.4-Mile Canal. Proposed Locks Require 400,000 Cu Yd of Concrete.

R. E. SMYSER, JR., M. ASCE
Colonel, Corps of Engineers,
District Engineer, St. Louis, Mo.

ON COMPLETION of the Chain of Rocks project, the last serious impediment to full utilization of the 9-ft channel extending from New Orleans to Minneapolis and the Great Lakes will be removed. Construction will proceed as funds are made available, but it is estimated that at least four years will be required to complete the project. Bids were received May 20 for the construction of the locks, the levees adjacent to the locks, and an access road. Work now under way consists of dredging a pilot channel to provide water access to the lock site during the construction period, and the construction of a bridge over the future canal to permit relocation of U.S. Highway 66. The bridge job was awarded to Bushman Construction Co. of St. Joseph, Mo., in August 1946, and substantial progress has been made on the foundations.

FROM THE EARLIEST DAYS of navigation on the Mississippi River, there has been a reach of the river just north of St. Louis Harbor that has interfered in varying degrees with river traffic. This section, known as the Chain of Rocks Reach, extends 7 miles along the northern boundary of the City of St. Louis, being roughly that section of river between Merchants and Chain of Rocks Bridges.

At two locations in the Chain of Rocks Reach, ledges of rock extend from the right or west bank under the river channel. These ledges act as natural weirs, or submerged dams, causing a sharp increase in slope with consequent excessive velocities. Under present conditions in this 7-mile reach, at low water there is a total fall of about 11 ft or an average of approximately 1.5 ft per mile. This fall can be compared with the average fall of about 0.5 ft per mile in the upper Mississippi River above the Chain of Rocks Reach and an average fall below that section from St. Louis to Cairo of 0.6 ft per mile.

The velocities produced in the Chain of Rocks Reach, sometimes exceeding 12 ft per sec, make this section exceedingly difficult to navigate, and require double tripping of even the most powerful towboats. Further, at extreme low water, the navigable depth may be reduced to as little as 5.5 ft, thus preventing full use of the improved waterway available above and below the Chain of Rocks Reach.

27,700,000 Cu Yd of Excavation

The approved Chain of Rocks plan contemplates a lateral canal on the left bank, or Illinois side, of the Mississippi River between river miles 184 and 194.5, with a large main and an auxiliary lock at the downstream end of the canal approximately due west of Granite City, Ill. In addition, a low-head movable dam with navigation pass is authorized just below Chain of Rocks Bridge, although construction is to be deferred until completion of the lateral canal, and further lowering of the low-water plane at Lock and Dam No. 26 makes it desirable.

BY CONGRESSIONAL RESOLUTION dated October 31, 1938, the Chief of Engineers was requested to prepare a report setting forth a plan of improvement for the Chain of Rocks Reach. This report was submitted on December 15, 1938, printed as House Document No. 231, and included in the River and Harbor Bill approved by Congress in 1939. However, this bill was vetoed by the President in view of the imminence of war. The project was again approved by Congress in the River and Harbor Act of March 2, 1945, and signed by the President.

Total Canal Length 44,300 ft

The north end of the canal will be approximately one mile south of the mouth of the Missouri River, and the south end of the canal will be adjacent to the Granite City Engineer Depot and approximately 3,800 ft upstream of Merchants Bridge. The canal will cross the slough behind Chouteau Island at several points and follow Cabaret Chute for 3 miles on the lower end. The total length will be approximately 44,300 ft, or 8.4 miles.

The bottom width of the canal will be 300 ft. The width at the top will be approximately 550 ft, the side slopes being 1 on 3. The depth of the cut will vary from 10 to 45 ft, the average depth being 32 ft. Excavation will be approximately 27,700,000 cu yd of earth, the material excavated being used in levees paralleling the canal.

The elevation of extreme low water of record at the downstream entrance to the canal is 376.8 ft mean sea level. Accordingly, the bottom of the canal downstream of the lock is at El. 362 ft, thus providing a depth of slightly less than 15 ft at extreme low water. This will permit further lowering of the low-water plane without entailing a deficiency of depth in this part of the canal. The elevation at extreme low water of record at the upstream entrance of the canal is 388.4 ft mean sea level. The bottom of the canal at this point will be at El. 378, leaving a minimum depth of 10.4 ft.

Longest Lock on Mississippi

Near the lower end of the canal, a 1,200-ft main lock and a 600-ft auxiliary lock will be located. Each lock will be 110 ft wide. The main lock will be the longest lock in the Mississippi River system and will permit passage of the longer tows now in service without the necessity of breaking tows. The upper lock gate sills will provide approximately a 14-ft depth at extreme low water of record, and the lower gate sills will be 16.8 ft below low water of record. Lock walls

will be approximately 92 ft high. The structure will be founded on bedrock except for the upper poiree sill, which will be on piles. About 400,000 cu yd of concrete will be required for the two locks.

The upstream gates are unusual. During the winter it may be necessary to pass ice through the lock chambers, and since it is impracticable to operate miter gates against an appreciable head of water, double-leaf vertical-lift-type gates are used. In addition, these gates will pass flow to aid in filling the lock chamber. Each leaf will be 30 ft high and each gate, consisting of two leaves, will weigh about 900,000 lb, or 450 tons.

The downstream gates will be of the miter type, and in the main lock each leaf will be 61 ft long, 72 ft high, and will weigh about 200 tons. In the auxiliary lock each leaf will be 43 ft high and will weigh 140 tons. The lock gates will be operated electrically.

Maximum Lift of 21 Ft

The normal lift of the locks will vary from 5 to 11 ft, depending upon river stage. After the auxiliary dam is built, the maximum lift of the locks at low water will be 21 ft. About 2,940,000 cu ft of water will be handled through the main lock for each lockage of 21-ft lift, and at this maximum lift the time required for filling the main lock is $7\frac{1}{2}$ minutes.

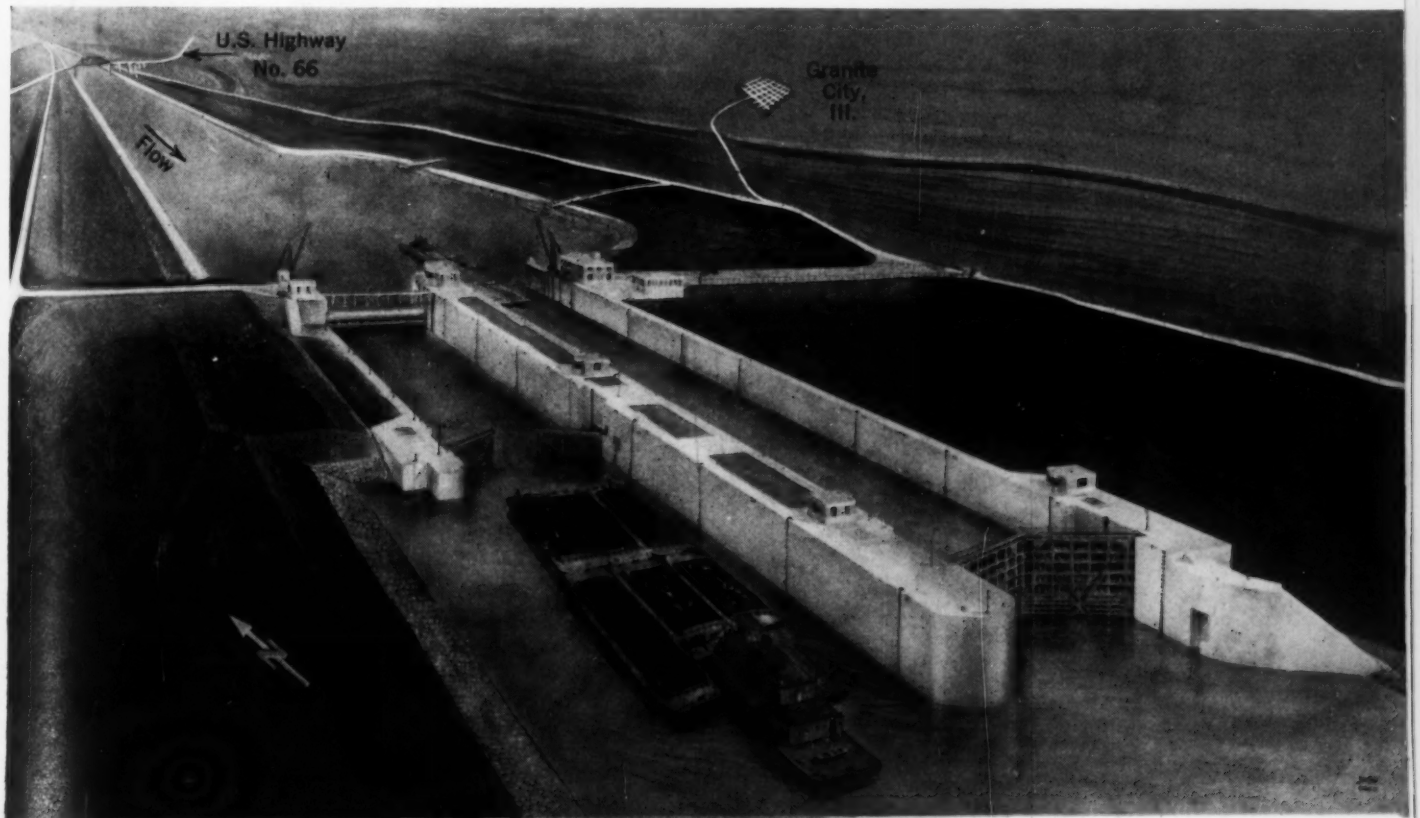
IMPROVEMENT OF the Mississippi River above the mouth of the Ohio in the interest of navigation has been under way since 1837, when Congress provided funds for construction in St. Louis Harbor. At present the authorized project provides for a dependable channel 9 ft in depth from the mouth of the Ohio River to Minneapolis, Minn. From Cairo, Ill., at the mouth of the Ohio River, to Alton, Ill., at river mile 202.9, improvement has been by open-river regulating works. Between Alton and Minneapolis, river mile 857.5, the 9-ft channel is obtained by a series of 25 locks and dams. The most southerly is the Henry T. Rainey Dam (Lock and Dam No. 26) at Alton, which extends the pool up the Illinois River for 80 miles, and, together with seven additional locks and dams on that river, makes a 9-ft channel available to the Great Lakes.

Levees will be constructed on each side of the canal to an elevation of 439.5 ft mean sea level to protect against a flood equal to the highest of record (1844) with 2 ft of freeboard (approximately 1,300,000 cfs). The width at the crown will be 20 ft. The toe of the levees on the canal sides will be about 150 ft from the edge of the cut to prevent displacement due to the weight of the levees. Berms extending out from the levee within 25 ft of the edge of the canal will be built to El. 421.

The levee on the east side of the canal will become a component part of the East Side river-front levee system which protects the valuable industrial area adjacent to East St. Louis, Ill.

If necessary after the canal and locks are complete, to insure adequate river depth at low water over the lower miter sill of Lock No. 26 at Alton, a supplemental low wicket-type dam will be constructed in the Mississippi River at mile 190.4 about 500 ft downstream from the Chain of Rocks Bridge. This dam will consist of a low concrete spillway with fixed crest at El. 395.7, extending from the Missouri bank riverward about 800 ft, 552 ft of additional spillway with sill elevation of 387, and 1,328 ft with sill elevation of 379.6, both provided with chanoine wickets. A navigable passage 780 ft wide will be provided in direct line with the navigation span of the Chain of Rocks Bridge. Sluiceways or conduits without gates are proposed under the

EARTH EXCAVATED from 8.4-mile canal—approximately 27,700,000 cu yd—is used in constructing levees paralleling canal as protection against flood equal to highest on record. Locks are at downstream end of 8.4-mile canal on Illinois side of river. North end of canal is approximately 1 mile south of mouth of Missouri River.



longer wicket sill to pass silt from the pool to the channel below the dam. Elevation of the pool is planned as 398 ft mean sea level.

Immediately above the locks the canal will be widened for a distance of 6,750 ft to a bottom width of 700 ft in order to procure material required for levees and to provide harbor facilities for industries in the Tri-Cities and others.

A bridge located east of the Chain of Rocks Bridge, approximately 3 miles west of Mitchell, Ill., is now being constructed to carry relocated U.S. Highway No. 66 over the canal. The bridge will consist of 17 spans and have an over-all length of 2,368 ft and a roadway width of 22 ft. The span over the canal will be 465 ft long and will have a clearance of 50 ft over the maximum stage at which the locks will be operated, with a clearance of 42.5 ft over high water. The height of the canal-span piers is 99 ft 4 in., and the depth of the footings for these piers is 7 ft.

Bids on New $9,500,000 Tacoma Narrows Bridge to Be Asked on or Before July 1

BIDS FOR CONSTRUCTION of a bridge over Puget Sound in the State of Washington to replace the ill-fated Tacoma Narrows Bridge that collapsed in 1940, will be asked on or before July 1, 1947. Concurrently, the sale of Toll Bridge Authority tax-exempt bonds to cover the cost of construction—including engineering and contingencies plus interest during construction—estimated at $9,500,000, will be advertised, according to Charles E. Andrew, chief consulting engineer, Washington Toll Bridge Authority. Construction is scheduled to begin in September 1947.

The total cost of the former bridge, including engineering and contingencies, plus interest during construction, was $6,559,545. Of this amount $2,964,150 was obtained through a grant from the Public Works Administration and the remainder through sale of a $3,750,000 bond issue.

To utilize the existing piers, which were uninjured by the failure of the former bridge and which are adequate to carry the heavier and wider superstructure, the same span lengths were retained. The new bridge will have a central span of 2,800 ft—the third longest suspension span in the world, being exceeded only by Golden Gate and George Washington Bridges. As to construction details, the old and the new bridges are comparable only in span length. Comparative dimensions of the former and new structure are:

Items	Former Bridge	New Bridge
Weight per ft of superstructure (lb)	5,700	8,700
Length (ft):		
Main span	2,800	2,800
Side spans	1,100	1,100
Total length (ft):		
Main structure	5,000	5,000
Bridge and approaches	5,939	5,979
Width of roadway between curbs (ft)	26	46'10"
Width of sidewalks (ft)	5	3'10"
Distance between cables (ft)	39	60

Safety Incorporated in Design Features

Designers of the new bridge have not only complied with the most rigid requirements of suspension bridge design as practiced in modern structures of this type but have in addition, through research and study, incorporated design features which provide safety against the aerodynamic forces that destroyed the former bridge. The engineers and scientists in charge of design and research are:

Charles E. Andrew, M. ASCE, principal engineer and chairman of consulting board

Glenn B. Woodruff, M. ASCE, member of consulting Board

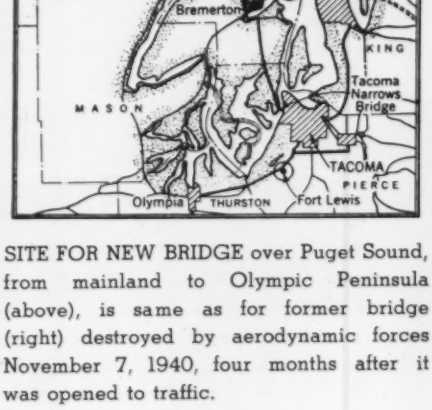
John I. Parcel, M. ASCE, member of consulting board

Dr. Theodor von Kármán, M. ASCE consulting aerodynamicist

Dexter R. Smith, designing engineer

Prof. F. B. Farquharson, M. ASCE, testing engineer

Approximately $250,000 has been spent by the state in design and research to complete the plans, and every practical means of guaranteeing safety has been incorporated in these plans. Records of traffic over the former bridge and on ferries now in operation offer conclusive proof of the necessity of a bridge from the mainland to the Olympic Peninsula (see location map). At present, all travel to and from the peninsula is by means of ferries in the vicinity of Seattle and Tacoma or by highways around the southern end of the sound through Olympia.



SITE FOR NEW BRIDGE over Puget Sound, from mainland to Olympic Peninsula (above), is same as for former bridge (right) destroyed by aerodynamic forces November 7, 1940, four months after it was opened to traffic.

Miami Improves Traffic Flow in Central Business District

EARL J. REEDER, M. ASC
Director, Department of Traffic and Transportation, Miami, Fla.

PAVEMENTS ARE MARKED for maximum number of lanes to aid drivers in making most efficient use of streets and new regulations. This street is marked for only three lanes because two blocks further on street is only 33 ft. between curbs. Posts along curb formerly held parking meters, but street is now restricted to stopping for loading and unloading of passengers and merchandise.

IMPROVEMENT OF TRAFFIC FLOW in Miami's highly concentrated central business district called for "decentralization" within the boundaries of the downtown area. Over a period of years an inflexible system of one-way streets had grown in this area, and a bus routing system held over from earlier days had concentrated large numbers of buses in the heart of the congested area.

Substantial results have been obtained from changes made in accordance with recommendations of a 3 months' parking and transportation survey conducted by the Department of Traffic and Transportation. In spite of an increase of 16 percent in traffic at the peak of the 1947 winter season over that at the same time a year ago, traffic movement through the central business district has substantially improved. As a result of the survey, a system of mass transportation routing, parking regulations, and traffic direction that would reduce the high concentration has been worked out. These improved conditions are based on four groups of changes: (1) Revision of bus routing and distribution of terminals; (2) revision of the use of curb space; (3) changes in one-way streets; and (4) complete laning of practically all downtown streets.

Several routes on which buses had slowly threaded their way through several blocks of congested traffic, making left turns at some of the most difficult corners, were changed to make shorter loops into the downtown area with right turns vastly predominating. As a result, the number of bus-blocks of operation in this area was reduced by 31 percent. At the same time, the number of left turns by buses was reduced 51 percent. The number of right turns was increased quite substantially (61 percent), but these are not nearly as serious as left turns in their effect on other traffic.

Priorities Applied to Use of Curb Space

In revising the use of curb space, a system of priorities was applied. The highest priority was given to the free movement of traffic with parking and standing of vehicles prohibited where they would interfere with such movement, particularly in places where irregularity of the street width created "bottlenecks." The next highest priority was given to the use of curb space for loading zones where vehicles might stop to receive or discharge merchandise or passengers if no off-street facilities were available for the purpose. Then, mass transportation stops and terminals were considered.

Taxicab stands which are somewhat flexible as to location and provide quick turnover in the use of parking space, were given priority over general parking. It was pointed out in the report of the survey that "street parking in the central business district should be confined to those curb spaces which are not needed for the other uses." Of course, such special uses were not to be condoned where they were not definitely needed.

Graduated Parking Time

The application of these priorities resulted in the prohibition of parking (except for loading or unloading) in the heart of the congested area, and brought about the graduation of parking time limits to a maximum of 90 minutes at the fringes of the downtown area. In some streets parking was prohibited on one side and permitted on the other, and at some points of special constriction in street width it was prohibited on both sides. Loading zones, bus zones, and taxicab stands were interspersed as conditions dictated.

The total number of available parking spaces within the central business district was reduced from approximately 2,080 to about 1,835, but the graduated plan of parking time limits increased the total number of cars that could be accommodated daily by about 38 percent through strict observance of the regulations. It was pointed out in the survey report that "in an area with as great a demand for curb parking space as in the central business district of Miami there is no place for all-day parking on the street."

ONE-WAY STREET CHANGES are important in increasing traffic flow in Miami's central business district. Changes permit establishment of new bus routings without conflict of two-way traffic. Traffic movements at intersections are improved by new regulations.

Construction of West Coast Building Proves Economical Use of Pumped Concrete

S. PERLITER, M. ASCE
Perliter & Soring, Engineers,
Los Angeles, Calif.

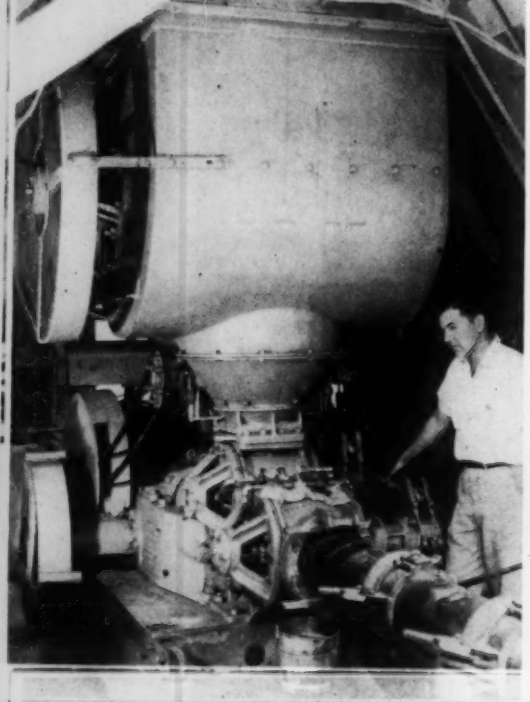
Pumpcrete machines were introduced on the Pacific Coast in 1932, when it was proved to the builders of Boulder Dam that the pumping method would be the ideal solution for placement of the 250,000 cu yd of concrete required on that project from 1932 to 1934. In 1934, 75,000 cu yd of concrete was pumped offshore into the piers of the San Francisco–Oakland Bay bridge, and from 1935 to 1937 more than 60,000 cu yd of Pumpcrete was placed in tunnels of the Colorado River Aqueduct of the Metropolitan Water District of Southern California. It was in this latter project that many of the original operating difficulties were overcome, and the present-day operating technique was perfected.

The first large building to be constructed with use of Pumpcrete in Los Angeles was the 17-story federal postoffice, where 50,000 cu yd of concrete was pumped into place. Thus through 16 years of Pumpcrete equipment development, pumping through a pipeline became a standard method of transporting concrete.

CONSTRUCTION OF A REINFORCED CONCRETE BUILDING in Los Angeles, Calif.—a department store owned by the May Co.—permitted a somewhat unique application of Pumpcreting equipment. Although use of Pumpcrete machines has been universally accepted in practically all other types of construction, many architects, contractors, and engineers engaged in general building work apparently have not recognized their adaptability and advantages as applied to the building industry. With the employment of Pumpcrete installations, a central plant and a pipeline to the delivery point is substituted for the slow, costly, bothersome use of elevators, towers, platforms, runways, and buggies. Pumpcrete equipment thus finds many applications, usually with substantial savings in expense and labor. Its simplicity allows greater freedom for other construction activities.

The May Co. Crenshaw store, when completed, will be a three-story, mezzanine and full-basement structure, providing approximately 261,500 sq ft of floor space, and containing 15,000 cu yd of concrete. It will have reinforced concrete floor slabs and roof, architectural concrete exterior trimmed with black Granux, and will be supported by 1,500 monotube piles capped with reinforced concrete mats 6 to 8 ft deep. Columns are spaced in a rectangular pattern 24×20 ft and vary in diameter from 30 in. in the basement to 15 in. on the third floor. Floor construction of the building is unusual in that 6-in. slabs are supported by beams 12 in. deep and 6 to 8 ft wide. Reinforced concrete exterior walls vary in thickness from 14 in. in the basement to 10 in. on the third floor.

PUMPCRETE MACHINE (Rex Model No. 200) under ramp has inlet and outlet valves synchronized to open and close with movement of piston, which forces concrete through supply pipe.



Ready-Mix Plant Supplies Concrete

Concrete for the May Co. building is supplied from a permanently located ready-mix plant two and a half miles from the construction site. Loaded transit-mix trucks back up to a short ramp and dump into a remixer set directly over a Pumpcrete machine which is centrally located in the construction area. From the Pumpcrete machine, concrete is pumped through an 8-in.-dia pipeline to all parts of the structure. The pipeline is made up of sections 10 ft long, held together by special quick-opening toggle couplings. Shorter lengths of pipe and a variety of elbows to facilitate pumping of concrete to any location and in any direction are also provided.

The concrete placing crew on the May Co. job is made up of three vibrator men, one hose tender, four shovel men, two clean-up men, and three pipe tenders—13 in all. When the building was 75 percent complete, the largest pour was made—406 cu yd in a 10-hour shift. The normal pour for Pumpcrete equipment of the size used on this job is 200 to 250 cu yd in an 8-hour shift. The longest length of pipe employed on this job

CONCRETE IS SUPPLIED from ready-mix plant $2^1/_2$ miles from site. Simple ramp arrangement permits two transit-mix trucks to discharge directly into hopper of Pumpcrete machine.

was approximately 475 ft of horizontal run and 40 ft of vertical run. In this arrangement a horse 6 ft high was placed under each 10-ft section of pipe, and a distributing spout was used to direct the concrete to the exact point desired.

Mix Designed for 3-In. Slump

Both mixes used on the May Co. job were designed to have a slump of 3 in. This is the most dependable moisture content for concrete that is to be pumped. However, satisfactory results have been achieved in pumping concrete with a consistency as dry as to give a 1-in. slump and as wet as to produce a 6-in. slump.

For slabs and mass concrete, where placing through reinforcing steel was not a problem, mix "A" was used. This mix has a 28-day strength of 3,000 lb per sq in., a maximum aggregate size of $1^1/_2$ in., a maximum volume of aggregate of 5.5 cu ft per sack of cement. This mix was designed as follows:

Material	Weight per Sack, Lb	Weight per Cu Yd Concrete, Lb
Cement	94	564
Sand	215	1,290
No. 3 gravel	235	1,410
No. 2 gravel	100	600
Water ($5^3/_4$ gal)	48	288
Total	692	4,152

Cement factor, 6.0 sacks per cu yd; weight of aggregate, 3,300 lb per cu yd (saturated surface dry).

Note: Weight of aggregate saturated surface dry is weight of material actually dry on the surface but containing sufficient moisture so that it will not absorb water from the mix.

For heavy reinforced sections, thin walls, columns and deep beams, mix "B" was employed. This mix has a 28-day strength of 3,000 psi, a maximum aggregate size of 1 in., and a maximum volume of aggregate of 5.0 cu ft per sack of cement. The design of mix "B" was as follows:

Material	Weight per Sack, Lb	Weight per Cu Yd Concrete, Lb
Cement	94	607
Sand	210	1,357
No. 3 gravel	290	1,873
Water ($5^3/_4$ gal)	48	310
Total	642	4,147

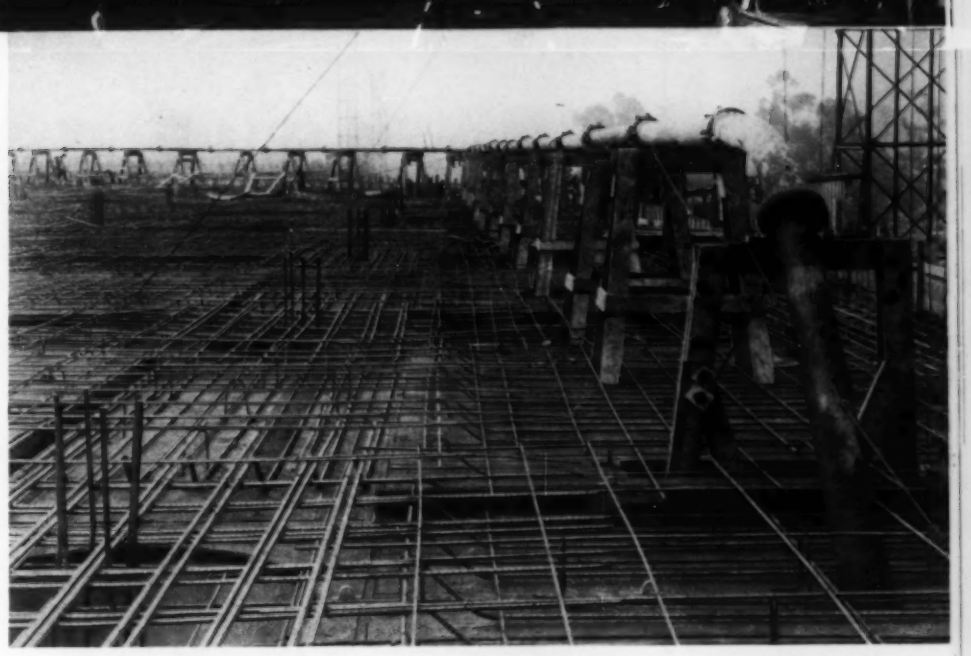
Cement factor, 6.46 sacks per cu yd; weight of aggregate, 3,230 lb per cu yd (saturated surface dry).

Two admixtures are being used in the concrete. For slabs on earth and concrete walls around basement and pits, 4/5 quart of Red Label Suconem per sack of cement is added. For exterior walls and sign wings, $^1/_2$ lb per sack of Plastiment is used.

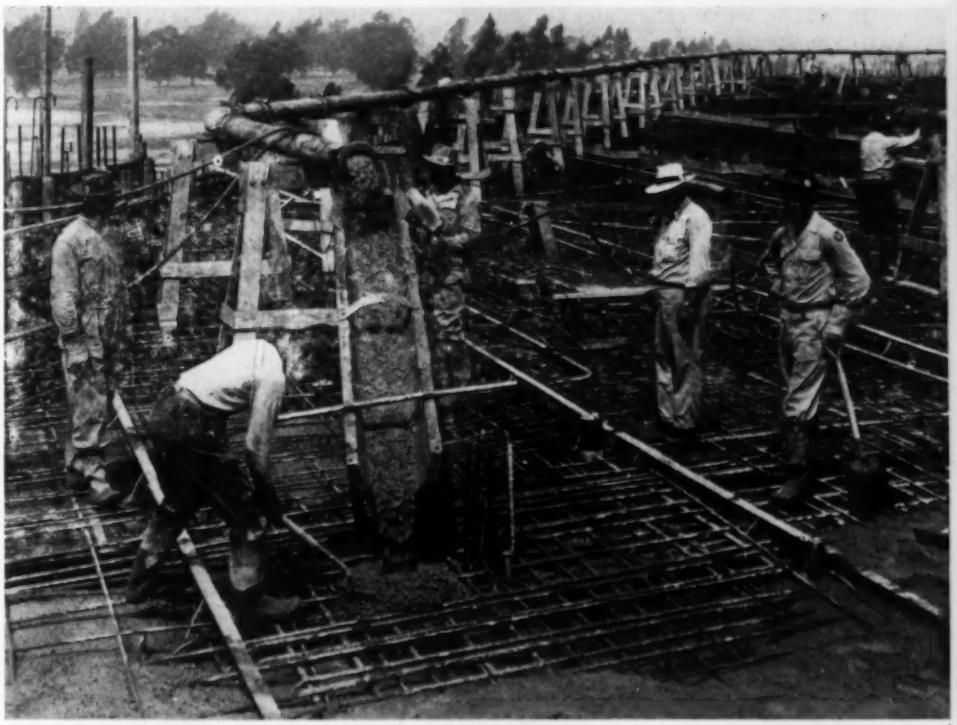
One of the greatest advantages found in placing concrete with Pumpcrete on this job proved to be that the area around the placing operations remained clear and free of runways, buggies, and other congestion, thus eliminating the necessity of additional labor and time for straightening reinforcing steel and other general clean-up work.

The May Co. Crenshaw Street store was designed by Albert C. Martin & Associates, architects and engineers of Los Angeles, and Samuel A. Marx of Chicago was associate architect. The Joshua H. Marks Co. is the general contractor, and the Pumpcrete equipment on the job is under the supervision of Albert Nicholson and Raymond Hamby.

The Pumpcrete machine proper is a heavy-duty single-acting horizontal piston pump, requiring a surprisingly small amount of power. Standard single-cylinder machines generally use 30-hp variable-speed electric motors or 40-hp gasoline engines. Double-cylinder machines are usually equipped with either 50-hp electric motors or 60-hp gasoline engines. Power costs for the pumping of concrete are approximately 1 cent per cubic yard.



CONCRETE PIPELINE EMERGES through third-floor slab form of May Co. building and is anchored at vertical bend and supported every 10 ft on 6-ft-high horses. Longest length of pipe on job is 475-ft horizontal and 40-ft vertical run.



FREEDOM FROM CONGESTION speeds work at point of placement. Movable chute is lengthened to cover considerable area within 180-deg arc. Largest pour on job is 406 cu yd in 10-hour shift; normal is 200 to 250 cu yd in 10-hour period.

THREE STORIES, MEZZANINE, AND BASEMENT of May Co. Department Store—totaling 261,500 sq ft of floor space—contain 15,000 cu yd of concrete. Reinforced concrete exterior walls range in thickness from 14 in. in basement to 10 in. at top.

Inlet and outlet valves in the pump are synchronized to open and close with the movement of the piston. On the suction stroke, concrete passes from the remixer through the inlet valve into the pump chamber. At the conclusion of the suction stroke the intake valve closes and the outlet valve opens, and on the forward stroke the piston forces the concrete through the discharge valve into the pipeline. On each stroke the concrete is moved a distance equal to the travel of the piston.

Proper planning of a construction job on which Pumpcrete is to be used is of extreme importance. The plant should be so located as to facilitate delivery of concrete to it and to minimize length of discharge lines. Lines should be laid on the shortest possible route that will least interfere with other construction operations and that will require the least amount of moving as work progresses. The alignment should be reasonably straight, and sharp bends should be avoided wherever possible, as the power required to pump through a 90-deg bend is equivalent to that used in pumping 40 ft in a straight line. Anchors must be provided at all bends to prevent the thrust at those points from displacing the line.

Pouring Progresses Toward Pump

Concrete placing for any particular pour should start at the point farthest from the Pumpcrete plant and progress towards the plant. This will allow pumping to go on continuously, as sections of pipe may be removed from the end of the line without halting operations. Placing of pipe supports over fresh concrete is eliminated in this manner, and plant output is increased.

At least a 50-ft horizontal run of pipe should be provided between the pump and a vertical rise in the line, as during pumping the inertia of the concrete in this section will tend to balance the back pressure from the weight of concrete in the vertical section. Further, the outlet valve on the pump will operate more easily and with less wear and tear. In order to gain spouting height, the line is usually supported on saw horses or cross frames.

The normal operating crew for pumping concrete is an experienced operator and a helper to run the plant and supervise pipeline layout. Just before pumping the concrete, it is advisable to pump a batch of mortar consisting of one part of cement and about 3 parts of sand and pea gravel to lubricate the walls of the pipe. One cubic yard of mortar will lubricate about 1,000 ft of 8-in. line. The first two batches of concrete following the mortar should have about 6 in. of slump. Thereafter, the normal mix for the job can be used to the completion of the pour. The level of concrete in the remixer should always be kept above the agitation shaft to prevent air from entering the pump chamber and becoming trapped in the line and eventually causing stoppage. A signal system for informing the operator when to start or stop pumping is essential.

Probably the most important single consideration in the pumping of concrete is proper design of the mix, with emphasis on gradation of aggregates. It is a common misconception that concrete for pumping must be wet, that is, have a high slump. This is decidedly not a factor. In fact, free water in concrete to be pumped is a serious obstacle. On the other hand, it is possible to pump concrete of proper mix design with slumps as low as 1 in. Practically any grade or quality of concrete can be pumped satisfactorily provided the mix is properly designed. Mixes that are poorly graded and those containing porous or highly absorptive aggregate or aggregates too large for the equipment to handle, have given trouble. Proper concrete mortar possesses good cohesive properties which in pumping support the coarse aggregates at the center of the pipe. Consistency, plasticity and density of the concrete govern the distance it can be pumped.

Quality and grading of sand play an important role in the pumping of concrete. Sand with 15 percent to 20 percent passing a No. 50 screen and 3 percent of this amount passing a No. 100 sieve, and with the coarser sizes properly proportioned, is the most favorable for pumping. However, thousands of cubic yards of concrete with sand of a coarser size than that mentioned have been successfully pumped. The sieve analysis of aggregate used on the May Co. job is given in Table I.

Aggregates Suitable for Pumping

Gravel is favored over crushed rock as a coarse aggregate in pumped concrete owing to its lesser surface area and its smaller percentage of voids. However, a well-graded cubical stone of normal specific gravity and low absorption is entirely satisfactory. Flat-breaking angular stone is not desirable as a coarse aggregate as it necessitates control of grading, proportioning and mixing.

Porous aggregates such as cinders and those produced from burned clay or from lava rock having a large percentage of voids will tend to dry up a mix and may stiffen it to a point where pumping becomes extremely difficult. This is because compressive action of the pump forces water into the pores of the aggregate, thereby drying up the concrete. Consequently, if an initially dry mix is being used, such further loss of moisture under pressure may make pumping impossible.

TABLE 1. SIEVE ANALYSIS OF AGGREGATE ON MAY CO. JOB

Washed Concrete Sand (Fineness modulus 2.77)		No. 3 Gravel (Fineness modulus 7.05)		No. 2 Gravel (Fineness modulus 8.0)	
Sieve Size	% Passing	Sieve Size	% Passing	Sieve Size	% Passing
No. 100	2.7	No. 4	1.3	No. 4	1.5
50	16.7	3	2.7	3/8" sq	1.9
30	44.5	3/8" sq	15.0	3/4" sq	5.2
16	72.2	1/2" sq	47.2	1" sq	24.6
8	92.8	3/4" sq	79.8	1 1/2" sq	90.0
4	99.7	1" sq	99.7	2"	100.0
3	100.0	1 1/2" sq	100.0		

It may be generally stated that for conditions favorable to pumping, concrete mixes should follow a smooth grading curve having no excessively flat or steep sections and should contain sufficient fineness to prevent particle interference for the particular cement content. It should be noted that no amount of pressure will pump stone, gravel or sand unless the particles are contained in a properly graded mixture with just sufficient liquid to make it fluid or, as in the case of concrete, unless the aggregates are made a part of a semi-fluid mass by the cohesiveness and lubricating properties of the cement mortar.

An all-important factor in building construction is the steady flow of concrete as it sets the pace for other construction. A good operator who understands the characteristics of the equipment is essential to the success of a Pumpcrete job. Obviously, if the equipment is to function properly, its maintenance is extremely important. Generally, about 50,000 cu yd of concrete can be pumped between major overhauls of equipment and before pipeline wear becomes noticeable. Pipe wear is actually very small owing to the low velocity of flow through it.

Go-Devil Cleans Pipeline

Upon completion of a pour, a "go-devil," which is a barrel-shaped object with a rubber cup on each end, preceded by a wad of wet burlap or paper cement bags, is inserted into the pipeline just forward of the discharge valve. This plug is forced through the line either by compressed air or by pumping water through it. The remixer should also be emptied of concrete at completion of a pour and flushed clean with water.

Reliable cost data on Pumpcreting have been compiled and show that the pumping method of concrete placement compares favorably with other methods on a wide range of projects. One classic example of a large saving concerns a mining company which reported a reduction in cost from $135 to $25 per cu yd in underground concrete placing. It should be relatively simple for any contractor, building or otherwise, to closely estimate Pumpcreting costs on any job, provided he could foresee or eliminate such present-day variables as changes in wage rates and material prices.

Nationally, the use of Pumpcrete since its recent origin has been extensive and has covered practically every type of construction other than general building work. The "Concrete Manual," published by the Bureau of Reclamation, U.S. Department of the Interior, states: "One of the most satisfactory methods of transporting concrete is by pumping through steel pipe lines. . . ." Records showing the amount of concrete pumped to date are not available, but it is safe to estimate that it is upward of 10 million cu yd. Pumpcrete equipment has become standard with many construction firms working on such diversified jobs as tunnels, locks, bridges, foundations, caissons, retaining walls, stadiums and the like.

Army Engineers Study Beach Erosion and Ocean Wave Damage

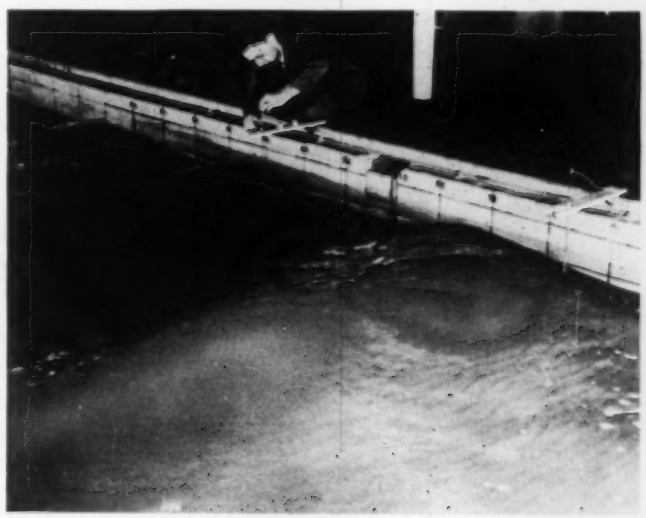
TO IMPROVE LABORATORY METHODS of reproducing action of ocean waves on beaches, a study has been initiated in the Washington, D.C., hydraulic laboratory of the Beach Erosion Board, by the Corps of Engineers. The study is designed to perfect the Beach Erosion Board's indoor testing methods so that small-scale laboratory waves will exactly reproduce the action of large ocean waves, or, if this cannot be done, to determine the amount of discrepancy and enable the research engineers to make such corrections to the laboratory results as to give a true picture of the conditions to be expected at actual beaches.

The Beach Erosion Board, of which Col. C. L. Hall, M. ASCE, is senior member, operates under Congressional authority in advising the Chief of Engineers on the solution of problems relating to erosion of beaches and damage to beach and shore property from ocean waves. The board also is charged with conducting research investigations into the basic causes of beach erosion and ocean wave damage and the best means of protection against them.

Exact laws governing the extent of beach erosion are difficult to determine, owing to the complex action of the ocean waves on sand beaches and the expense of observing this action. Fortunately, many of the laws governing this action can be determined by studying them indoors, in small tanks, using artificially generated small-size waves. However, so that the results of these small-scale studies can be used, some means must be taken to find out if and in what way the laboratory waves do not exactly reproduce the action of large ocean waves.

Tests are being conducted in two model wave tanks, in each of which typical beach profiles, or inclines, are molded (see photo). Clean bank sand is used. Only a limited number of tests have been made to date, and no definite conclusions can be made at this time. Additional tests are now under way.

Test observations to date indicate that the size of sand grains in the small tank must be reduced at about the same scale as the size of the waves to insure the greatest similarity of action between the two tanks.



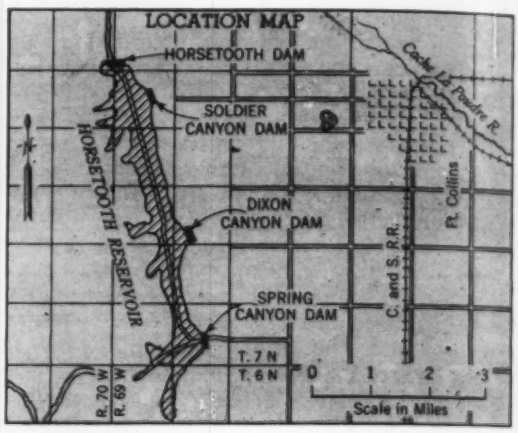
ACTION OF ARTIFICIALLY generated waves on different types of beaches are studied in large tank 85×14×4 ft (shown here) and small glass-side steel flume, 42 ft by 1 ft 5 in. by 2 ft deep, to establish relationship between two models. Laws governing relationship of two tanks will be used to determine action of actual beach waves through comparison with results obtained in large laboratory model

Four Earthfill Dams Create 1,873-Acre Horsetooth Reservoir in Colorado

$11,000,000 STORAGE RESERVOIR IS PART OF COLORADO-BIG THOMPSON PROJECT

FRED C. WALKER
Engineer, Bureau of Reclamation, Denver, Colo.

HORSETOOTH RESERVOIR—formed by construction of earth embankments—is located about 4 miles west of Fort Collins, Colo., in a dry narrow valley paralleling the front range of the Rocky Mountains and immediately behind the first ridge or hogback forming the eastern edge of the mountains. All structures in this $11,000,000 project were designed by, and will be built under the direction of, the engineering staff of the Bureau of Reclamation of the Department of the Interior. Construction of the Horsetooth and Soldier Canyon Dams will be by Grafe-Callahan Construction Co., Gunther & Shirley Co., and W. K. McIlyar. Spring and Dixon Canyon Dams are being constructed by Hinman Brothers Construction Co. and Rhoades Brothers & Shofner. The reservoir will be approximately 6½ miles long and from ½ to ¾ of a mile wide, and will cover 1,873 acres at a full water elevation of 5,430. Of its storage capacity of 147,322 acre-ft of water, about 137,000 acre-ft is active storage.



IN ITS SIMPLEST FORM the Colorado–Big Thompson project plan consists of diversion of Colorado River water to be stored in Granby Reservior and the compensatory storage of flood water in Green Mountain Reservoir on the Blue River for release to the Colorado River. Water stored in Granby Reservoir will be pumped up to Shadow Mountain Lake, from which it will pass to Grand Lake and into the 13-mile-long Alva B. Adams Tunnel under the continental divide. From the outlet of the tunnel to the Horsetooth and Carter Lake Reservoirs, the water passes through a series of tunnels, canals, and power plants to utilize approximately a half-mile drop in elevation for the production of power.

Horsetooth Reservoir in combination with Carter Lake Reservoir will form the terminal storage facilities on the long string of reservoirs, canals, tunnels, power plants, and pumping plants used to convey the water of the Colorado River to the Eastern slope of the Rocky Mountains for the irrigation of the plains area north and east of Denver, Colo. Supplemental water will be supplied to 615,000 acres now inadequately irrigated from the waters of St. Vrain, Little Thompson, Big Thompson, Cache La Poudre, and South Platte Rivers.

Water enters Granby Reservoir at a highly erratic rate dependent upon runoff rates from the drainage area. From Granby Reservoir to Horsetooth and Carter Lake Reservoirs the water, except for minor variations, will move at a constant rate of 550 cfs. The demand for water for irrigation is also highly erratic, hence the storage requirements immediately adjacent to the irrigated lands. Under recent plans this storage is provided for by Horsetooth Reservoir for the northern lands and by Carter Lake Reservoir for the southern lands of the project.

The Horsetooth Reservoir basin was formed by the erosion of the softer formations from between the uptilted harder sedimentary beds. The basin will be closed at the northern end through the construction of Horsetooth Dam and Satanka Dike. The hogback forming the eastern side of the reservoir is cut at three places by steep-walled canyons which are

FOUR MAJOR SOURCES OF MATERIAL are available for embankment construction: overburden in reservoir floor, prairie deposits, gravel stream deposits and rock of various sedimentary beds. Shown here are stripping operations on south abutment of Soldier Canyon Dam. Reservoir is at upper right.

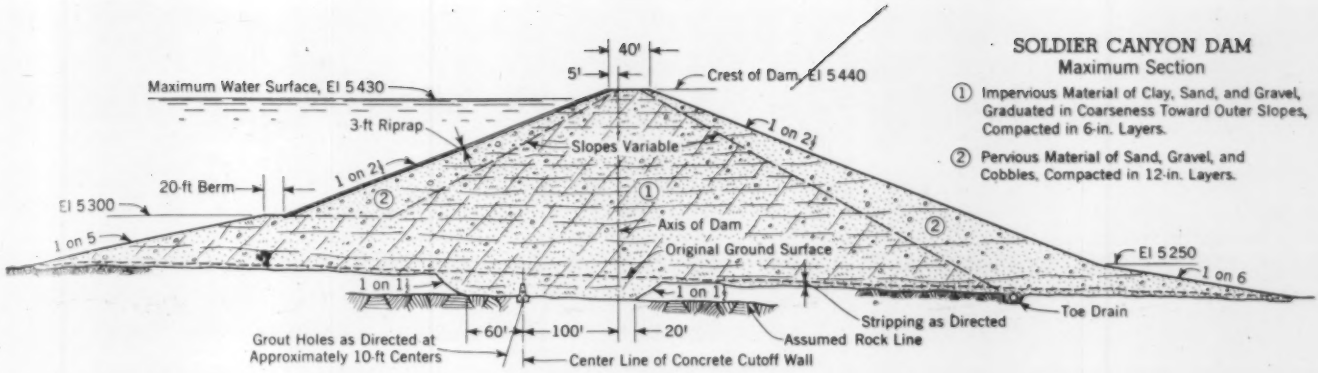


FIG. 1. MODIFICATION OF "Swedish Slip Circle" is used in stability studies to determine factor of safety of various dam sections such as that for Soldier Canyon Dam, shown here. Widely divergent cost of procuring different types of materials determines that section with slope of 1 on 2½ and slope on core section of 1 on 1½ produce lowest-cost dam with minimum acceptable factor of safety. Section meets all requirements of satisfactory dam, provided that suitable riprap layer is placed on upstream face, and provided that if rockfill from formations is used for shell material, a transition zone of fine-graded, semi-pervious material is placed between rockfill and core. Impervious material is extended upstream at 1-on-5 slope for lower part of fill, below El. 5300.

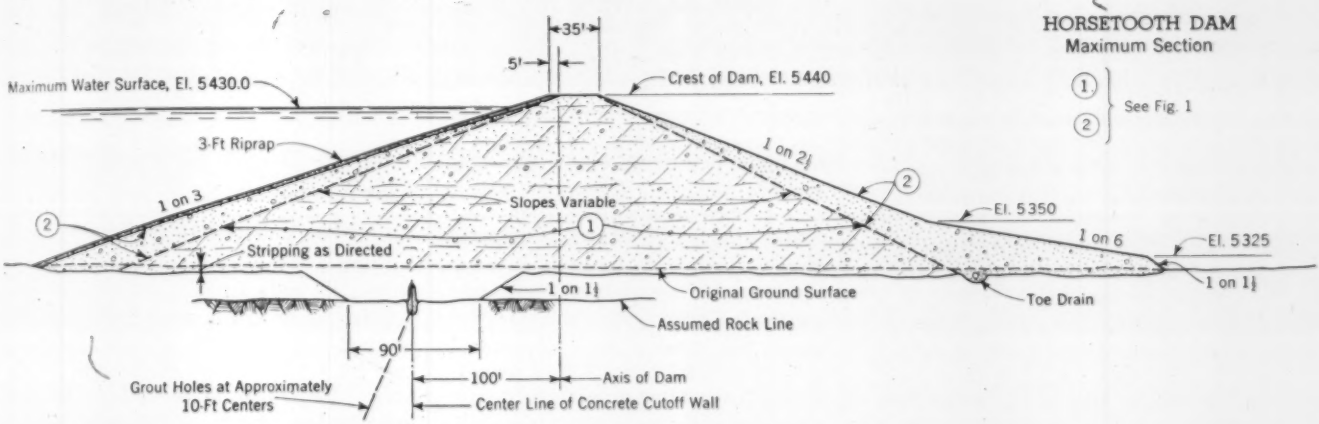


FIG. 2. AT HORSETOOTH DAMSITE, where lower dam is required, somewhat different section proves most economical. Here, downstream slope of 1 on 3 with nominal pervious layer and downstream slope of 1 on 2½ for top 90 ft, and 150-ft-long supporting fill on 1-on-5 slope, with limited pervious fill, are found most suitable.

to be closed by the construction of Soldier Canyon, Dixon Canyon and Spring Canyon Dams. On the southern end, the floor of the eroded basin rises sufficiently high to prevent loss of the reservoir through this gap. The western side is formed by the Rocky Mountains.

There are no major faults in the reservoir area, and the few minor faults all run parallel to the strike of the formations. One such fault crosses under the Horsetooth Dam. It was detected only through a discontinuity in one drillhole and is not expected to cause any serious construction difficulty. More information about it will be disclosed during foundation stripping operations.

Four Major Sources of Material

For embankment construction, four major sources of material are available. These are the overburden in the reservoir floor, the prairie deposits outside of and east of the reservoir, the gravel stream deposits in the Cache La Poudre Valley north of the reservoir, and the rock of the various sedimentary beds. The quantities required are shown in Table I.

The overburden materials of the reservoir floor are the most accessible to all of the damsites, but the quantity available is limited. There are minor quantities of gravelly material available but generally the material is fine graded and impervious.

The prairie deposits are not quite as accessible as the reservoir deposits as they require more of an uphill haul and also a greater haul distance.

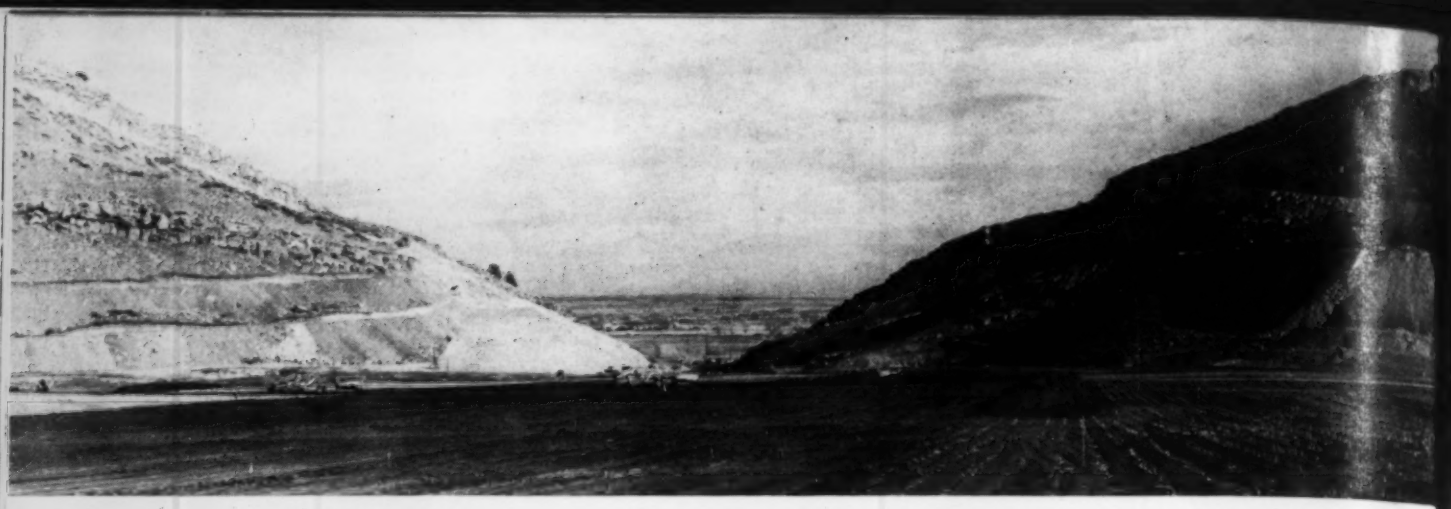
TABLE I. EMBANKMENT DIMENSIONS

Dam	Height Ft	Crest Length Ft	Impervious Fill Vol. Cu Yd	Pervious Fill Vol. Cu Yd
Horsetooth	125	1,600	1,450,000	405,000
Soldier Canyon	205	1,400	2,450,000	822,000
Dixon Canyon	220	1,200	2,000,000	1,000,000
Spring Canyon	205	1,110	1,425,000	785,000

The material is somewhat coarser and better graded than the reservoir deposits. Ample material is available but its use would require the destruction of some fairly valuable farm land and its quality is not sufficiently better to justify a more economical design than is possible with the reservoir deposits. Economic considerations would limit its use to a supplementary source in order to complete the requirement for impervious material.

The stream gravel deposits in the Cache La Poudre Valley will supply suitable pervious materials. Sufficient quantity is available but the haul distance would be from 2 to 4 miles to the closest dams and between 6 and 10 miles to the further dams. No other deposits of gravelly materials suitable for pervious and semi-pervious embankment in appreciable volume have been located.

Characteristics of the embankment materials are shown in Table II. In performing laboratory tests on these materials high pore pressures were developed, ranging from



HOGBACK FORMING EASTERN SIDE of reservoir is cut at three places by steep-walled canyons which are to be closed by construction of Soldier Canyon, Dixon Canyon and Spring Canyon Dams. Operations at Dixon Canyon Dam site, shown here, are at 5,300-ft elevation.

about 50 to 80 percent of the applied load. Insufficient data have been accumulated so that a positive correlation between the behavior of the material in the laboratory and the embankment can be made. However, as pressures of 60 to 70 percent of the superimposed load have been recorded in impervious materials used in other dams, a design assumption approximating such a condition appeared to be in order.

The design problem resolved itself into an appraisal of the probable cost of utilizing any of the available materials either alone or in combination for the construction of safe and practical dams on the foundations available, and selection of the scheme providing a minimum overall cost.

The earliest design studies were started more than ten years ago based largely on assumptions as to the character of both the foundations and the construction materials, for the primary purpose of establishing the probable cost of construction. The preliminary cost estimate was in turn used for economic studies for the project as a whole and to establish the cost of the project so that Congressional authorization might be obtained and a repayment contract consummated with the water users.

Because of the size of the dams involved, zoned construction was deemed necessary; that is, a dam is composed of several sections in each of which the material used is selected to perform a specific function as contrasted with a homogeneous dam where the material selected must be capable of performing all the required functions of a dam. The major functions are watertightness, stability, protection from erosion, protection from percolating water, and protection from reservoir operation. There are also other factors to be considered such as damage by floods or earthquake, which are functions of the design rather than selection of materials.

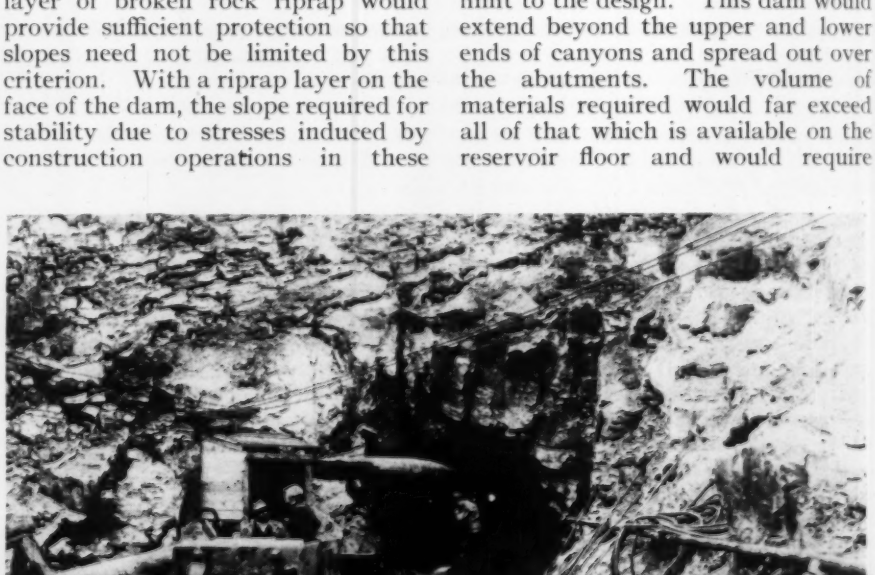
TABLE II. EMBANKMENT MATERIAL CHARACTERISTICS

Location	Gradation, %				Dry Density	Moisture Content,	Percolation	Cohesion	Friction
	Clay	Silt	Sand	Gravel	Lb per CuFt	%	Ft per Yr	Psi	Tan ϕ
Reservoir	7.3	33.2	41.7	17.8	113.3	14.6	0.013	7.0	0.75
Prairie	18.3	12.7	42.7	26.3	118.7	13.6	0.013	5.5	0.83
Lykins Shale	29.9	34.7	28.5	6.9	106.2	18.1	0.066	7.8	0.58

The materials from either the reservoir or prairie deposits would produce sufficient watertightness but could not meet any of the other requirements without utilizing very flat slopes. Past experience has shown that slopes approaching 1 on 20 would be needed for permanent protection against erosion and beaching action, but that a relatively thin layer of broken rock riprap would provide sufficient protection so that slopes need not be limited by this criterion. With a riprap layer on the face of the dam, the slope required for stability due to stresses induced by construction operations in these materials would be approximately 1 on $4^1/_2$.

More Economical Dam Possible

Such a dam, properly constructed, would be safe from the effect of reservoir operation and percolating waters, but a more economical dam can be built of the materials available. Such a dam would define one limit to the design. This dam would extend beyond the upper and lower ends of canyons and spread out over the abutments. The volume of materials required would far exceed all of that which is available on the reservoir floor and would require



OUTLET PORTAL of Soldier Dam tunnel is holed through. Tunnel consists of concrete-lined, 5-ft-dia pressure section upstream and 6-ft horseshoe section downstream. Outlet through dam eliminates need for long side-hill canal to supply water to area east of reservoir.

extensive borrow-pits in the prairie area.

The above dam design would produce far more watertightness than is needed, so a pervious material with good stability characteristics could be substituted in the outer portions of the dam. Up to the angle of repose of such material, slopes could be progressively steepened as the core section of watertight material is decreased. The thickness of the stable material must be great enough however, to withstand the thrust of the weak, impervious core under all conditions. A limit is reached with a vertical face on the dividing plane between the two materials. A thin vertical wall of impervious material would produce sufficient watertightness but would require a very carefully constructed transition zone to prevent damage from percolating water because of the high gradient between the two faces of the impervious zone. Such a dam properly constructed with materials available would require outside slopes of 1 on 2. (See Figs. 1 and 2.)

Refinements in analysis both for stability and cost showed that the two southern dams on the eastern side of the reservoir could be most economically constructed with a rock-fill shell utilizing quarry fines for the transitional zone. Although theoretical considerations would make it unnecessary to have this zone more than 1 or 2 ft thick, practical considerations require a zone sufficiently thick to facilitate construction and as much thicker as necessary to utilize all the quarry fines produced. As accurate estimates cannot be made of the quantity of fines, the thickness of the transitional zone will be adjusted as quarrying operations proceed. As rock fill is not expected to be as heavy as gravel fill, it was found necessary to make the shell of these dams slightly thicker than that required for the northern canyon dam where river gravels will be used.

Supporting Fills Added

Small supporting fills were added on the downstream side of each of the canyon dams as an additional safeguard at the point where the foundation was considered to be the weakest. Toe drains are located near the upstream edge of the downstream pervious fill to collect any water that percolates through the dams or along the contact between foundation and fill. The steep downstream dip of the bedrock and the resulting sawtooth appearance of sections along the abutments makes it highly improbable that any seepage through the foundation would find its way to the drains.

SEDIMENTARY ROCKS forming foothills zone of Rocky Mountains comprise entire reservoir area. Here Speed-shovel powered by Caterpillar Diesel engine, with 2½-yd bucket—equipment of Rhodes Brothers & Shofner, contractors—works in rocky soil at Horsetooth Dam site.

RESERVOIR BASIN Is formed by erosion of softer formations between uptilted sedimentary beds. Beds of red shales are covered by from 3 to 20 ft of sandy loam overburden, with occasional spots of sand and gravel, nearly all of which will be used for embankment construction. Here fill material for Horsetooth Dam is spread by D8 tractor with bulldozer.

Foundation treatment at each of the dams consists of a wide-base cutoff trench with a cutoff wall. The cutoff trench is made wide because of the variable nature of the foundation materials so as to insure having a bond to competent material at some point along any section of the dam. Cement grout will be used wherever feasible and necessary to stop leakage through the foundation. The cutoff wall will form an effective barrier against water which would seep along the contact line between bedrock and the fill and also as a base for the grout fittings.

The drainage area contributary to the reservoir is only about 10 ½ sq miles. The most dangerous type of runoff at this location is the high-peak, small-volume flash flood. It is estimated that the maximum probable flood would only raise the surface of the reservoir a foot or so, therefore no spillway is provided. However, in the eventuality of an operating error, some positive means of preventing overfilling of the reservoir should be provided. Northwest of the Horsetooth Dam there is a small, low saddle which will be closed by Satanka Dike. The crest of this dike is purposely left 4 ft lower than all the other dams so that in case of overfilling a failure will occur at this location and the resulting damage and loss of water can be kept to a minimum.

Outlet structures will be provided at Horsetooth and Soldier Canyon dams. The principal outlet at Horse-

(*Continued on page 82*)

Three-Million-Dollar Tacoma Sewer Project Employs Machine-Made Joints

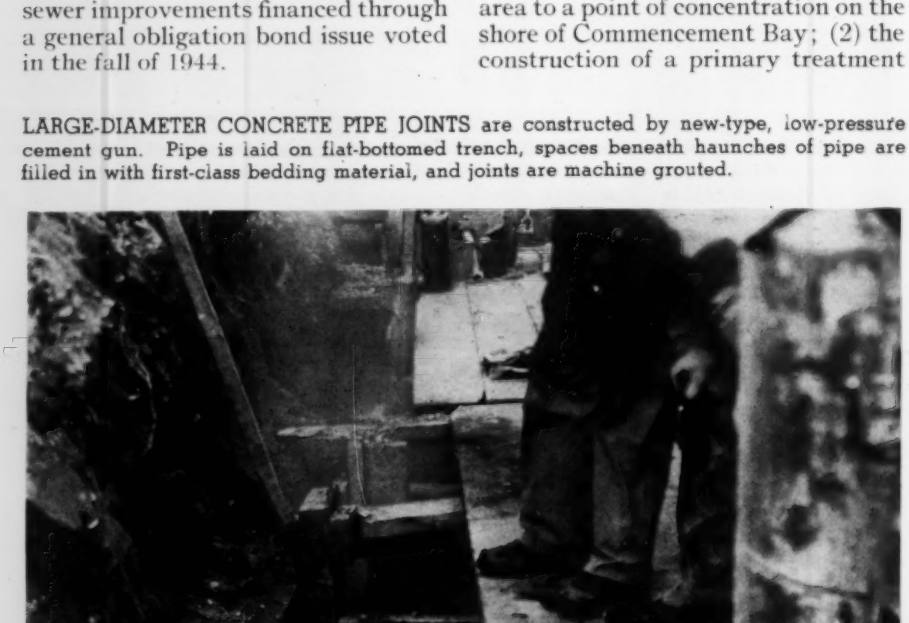
C. S. SEABROOK, ASSOC. M. ASCE
Sewer Engineer, Department of Public Works, City of Tacoma, Wash.

IN KEEPING WITH THE GENERAL TREND OF AFFAIRS, Tacoma is engaged in quite an extensive program of postwar public works. Among many other items of construction is a $3,000,000 program of sewer improvements financed through a general obligation bond issue voted in the fall of 1944.

For analytical purposes this sewer program can generally be divided into three principal parts: (1) The construction of several long trunk sewers serving the southerly half of the city and conveying the sewage from this area to a point of concentration on the shore of Commencement Bay; (2) the construction of a primary treatment plant at this point; (3) the extension to 40 ft below mean lower low water of nine existing outfalls now discharging at high-tide line along the north shore of the city.

These north shore outfalls are so located relative to the currents in Commencement Bay that upon completion of the proposed extensions the sewage will be carried out to deep water, rendering treatment unnecessary. The outfalls from the southerly half of the city on the other hand discharge into the head of Commencement Bay where sufficient water movement for satisfactory dispersion is completely lacking. Primary treatment is therefore the only solution to the problem.

LARGE-DIAMETER CONCRETE PIPE JOINTS are constructed by new-type, low-pressure cement gun. Pipe is laid on flat-bottomed trench, spaces beneath haunches of pipe are filled in with first-class bedding material, and joints are machine grouted.



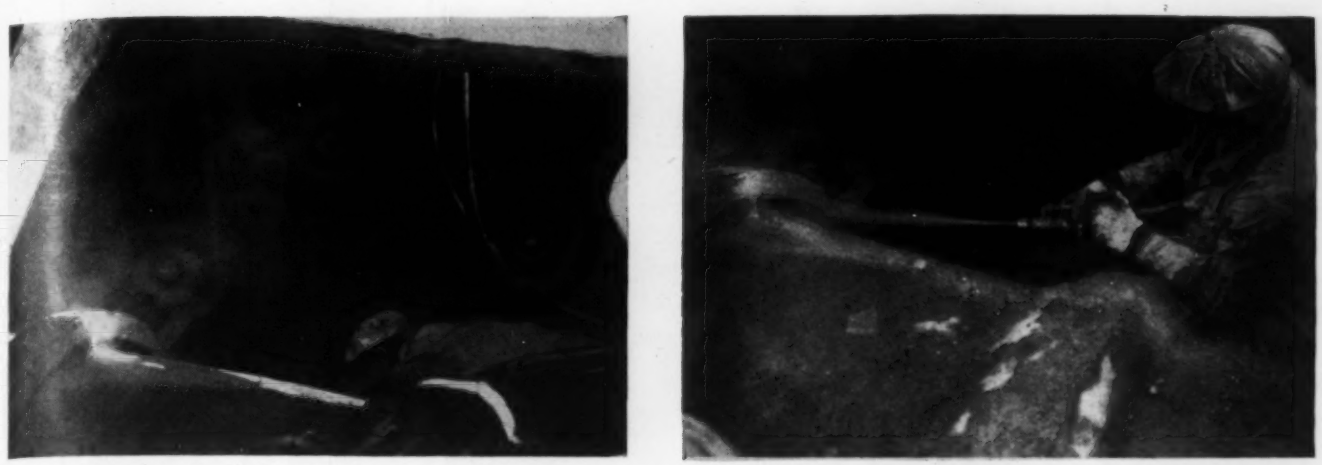
Two More Contracts Awarded

At the present writing one $370,000 contract for the construction of the South Tacoma Trunk is about half completed. Two other contracts, one for a pumping station on the South Tacoma Trunk at $100,000, and another for the construction of the Oakland Trunk Sewer at $150,000, have just been awarded. Two of the deep-water extensions have been completed and the treatment plant is in the preliminary stages of design. All design and construction work is being handled by this office.

Aside from the conventional problems normally associated with sewer work, quite a number of not-so-normal situations have been encountered to date necessitating no inconsiderable amount of head scratching. For example, since the area tributary to the proposed treatment plant is now served by an ancient system of combined sewers, some plain and fancy shuffling was required to emerge with anything resembling a reasonably separated system.

Unconventional Methods Used

In connection with the design of an interceptor to carry the flow from several existing outfalls to the site of the treatment plant, the inherent peculiarities of the existing outlets necessitated the design of overflow structures that resemble nothing so much as the ramblings of a modern-



BEGINNING AT BOTTOM (left) grout is sprayed in joints, working upward one side at a time (right) until top is reached. Machine process eliminates vexing problem of obtaining watertight joint at bottom of pipe. Dry 1: 2 mix gives hard, dense joint with excellent bond between mortar and pipe.

istic artist. As a result of such problems as these, the office finally became so accustomed to unorthodox thinking that it began laying the ax around on many of the conventional evils normally tolerated in sewer work.

As one example, the time-honored specification requiring a pipe to be bedded in a cylindrical depression in the bottom of the trench was unceremoniously tossed out of the window. The theory which originally motivated this requirement is sound enough, but there are two difficulties which in most cases thoroughly nullify its usefulness. In the first place few contractors will actually provide such a depression, and in the second place if perchance the depression is provided it will virtually never exactly fit the pipe, and unless the fit *is* perfect, harm rather than benefit is very apt to result. A far superior bearing will be achieved if the pipe is laid on a flat-bottomed trench and the space beneath the haunches of the pipe filled in with a first-class bedding material such as sand—water-settled, if required. This is the type of construction now specified by this office.

New-Type Jointing

The most interesting and noteworthy development on the job, however, has been the new type of jointing employed. Several of the trunk sewers to be constructed had to be placed at elevations below the normal groundwater level. In addition, the flow from these lines had to be pumped. Obviously, nothing very much short of a perfectly watertight joint could be tolerated.

Of course, watertight joints can always be constructed if money is no object. However, since money is and always should be an object, no matter how much of it one may have at his command, this office set about devising some sort of joint that would at the same time be waterproof, foolproof and economical. Asphaltic-type joints were thought of in passing but were given little serious consideration, for wet trenches in a wet country do not provide the ideal condition necessary for constructing successful asphaltic joints.

Finally, through the process of elimination, it became evident that our only hope lay in a joint fabricated with a Guniting machine or something very closely related to it. To the best of our knowledge this process had never before been employed in sewer work, and although a standard Gunite machine, because of its large nozzle and high working pressure, was obviously not particularly adaptable to this type of work, it was nevertheless believed that with a little working over, one of these machines could be made to do the trick.

Joints Tested in Laboratory

Most experts with whom the matter was discussed exhibited little enthusiasm for the idea, and even the local contractors who were personally interested in Guniting were loathe to commit themselves or offer anything in the way of moral or physical support. We were determined to proceed with the idea regardless. At about this point it was discovered that at one time the City of Seattle had conjured up the same idea and had gone so far as to Gunite a few joints in the laboratory. Although the anticipated annoyances had been experienced, the resulting joints were a marvel of excellence. Broken open, these samples divulged a homogeneous mass of concrete with the bond between the mortar and the pipe so perfect that no line of demarkation could be found, even with a cold-chisel.

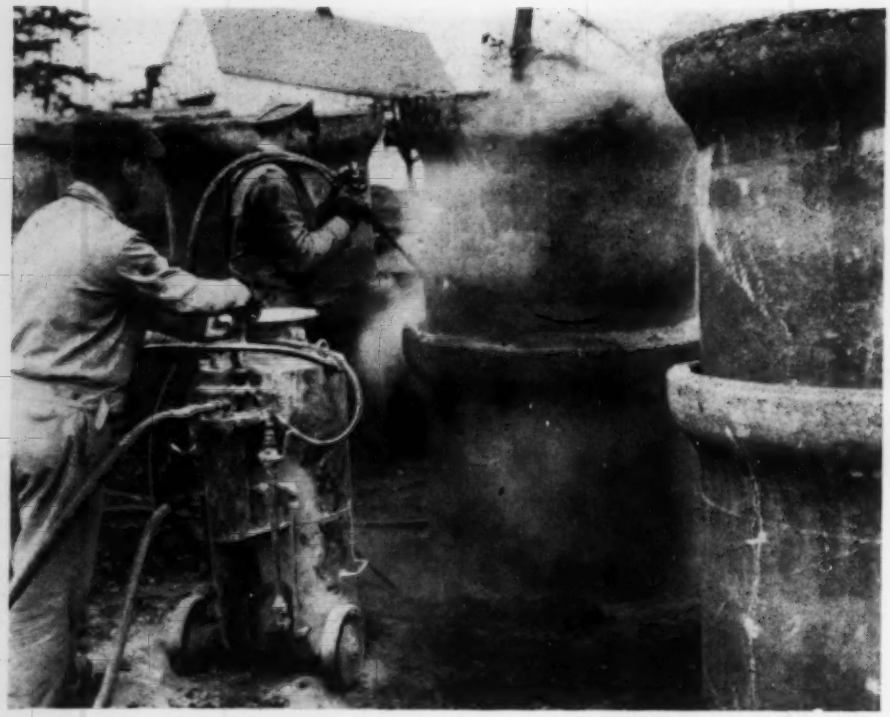
The laboratory experiments were the limit to which Seattle had gone with the development, but they so perfectly supported our contentions regarding the process that our specifications for the South Tacoma Trunk were written up calling for this type of joint. Alternate specifications for conventional mortar joints were included as a factor of safety and as a means for securing comparative cost data, but there was no intention of accepting anything but the Gunited joints unless the price bid was entirely out of reason.

New Grouting Machine Utilized

Upon opening the bids, it was found that the low bidder had quoted $12,000 higher on the Gunite joints than on the mortar joints, the total bid on the former being $370,000. This, in our opinion, was somewhat high but considering the necessity for tight joints, and the fact that the process was entirely new, a 3 percent premium for good joints did not seem too excessive and the contract was consequently awarded on this basis.

Unknown to this office, a miracle apparently had been in the making, for almost simultaneously with the awarding of the contract a Mr. Ben Nickolson of Seattle announced the completion of a new machine designed expressly for the jointing of sewer pipe by a method almost identical with the Guniting process.

The Nickolson Grouting Machine, as it is called, differs from the Gunite machine primarily in the manner in which the dry sand and cement are mixed, and in the much smaller noz-



JOINTS OF TWO 3-FT SECTIONS of 36-in. pipe are made before lowering into trench. Grouting machine has $3^1/_2$-cu ft capacity, is small, compact and mobile. Sand and cement, mixed by air jets inside machine, are brought by compressed air to nozzle where water is introduced.

zle and the lower air pressure used. These last two features, of course, eliminate the anticipated difficulties in using a standard Gunite machine for pipe jointing. The sand and cement, mixed by air jets inside the machine, are brought to the nozzle by compressed air. Water is then introduced, as with a Gunite machine. The grouting machine has a $3^1/_2$-cu ft capacity, is small and compact, and is mounted on two small wheels. Additional machines upon which Mr. Nickolson is now working to supply the demand already beginning to develop, will vary in some details from the original model now in use, but no radical change is anticipated.

Construction of Joint

The first step in making a joint is to wash the area to be jointed with a spray of clear water from the nozzle. Then, beginning at the bottom, the grout is sprayed into the joints, working upward on one side at a time until the top is reached. A mix of 1:2 is used and the quantity of water is varied to suit the need. In general, a very dry mix is used and the resulting material is so dense that an instant after the joint is completed the material can scarcely be dented. On that portion of the line involving a 36-in. bell-and-spigot pipe with unusually large bells, 5 to 8 min was required to complete a joint under the most adverse condition. The trench on this part of the line was over 20 ft deep, heavily cribbed and braced at the bottom with no more than 12 in. of clearance at the sides of the pipe. Exceptionally bad water conditions in the trench bottom were encountered.

Human Equation Largely Eliminated

One of the most outstanding features of the new process is the degree to which the human equation is eliminated. With conventional mortar joints, the bottom of the pipe always presents the most vexing problem, and no amount of careful inspection can insure a tight joint at this point. With the machine process, however, although the bottom is still the critical point, the difficulties have been so radically reduced that with ordinary careful inspection, one can expect just as good a joint at the bottom as at the top.

Both bell-and-spigot and tongue-and-groove pipe are being used on the job and the machine works equally well for both. The tongue-and-groove pipe is so constructed that the ends of adjoining sections butt on the inside and leave about a $^3/_4$-in. opening on the outside. This space is filled up, and a rough collar fabricated with the grouting machine. To "shoot" the bottom of this joint, a depression a few inches deep is excavated beneath the joint and the whole space filled in with grout.

Joints Tested and Inspected

Although it seemed unnecessary to make such a test, four jointed sections of 36-in. pipe were stood on end on the bank and subjected to a 10-ft head of water. As expected, there was no leakage. More to the point, however, periodic inspections of the inside of various completed portions of the pipeline, backfilled, and under a natural head of groundwater, indicated that although immediately after being subjected to the outside water pressure, an occasional minor leak was in evidence, these leaks were so small that after a few days they were completely sealed by the natural infiltration of silt.

The grouting machine has various other advantages in addition to making the joints for which it was designed. Short-radius curves on large pipelines were satisfactorily and economically constructed by fitting together wedge-shaped sections of pipe produced by scoring the green pipe as it came from the forms and later breaking it along the scored lines. These sections were bonded together far more securely and with decidedly less trouble than would have been possible with hand work. In several cases, the bells of certain pipe sections had been so badly broken in handling that normally they would have been rejected. With the grouting machine, however, it was a simple matter to build up the broken parts at the same time the joint was made, resulting in a pipe that was doubtlessly stronger than the original.

Cost Considerations

The cost of making this new-type joint is at the moment problematical and will probably remain so until, through usage, some stabilized procedure has been established. The labor unions in this locality have required that four men be used in operating the machine—a compressor man, a mixer man, a machine man and a nozzle man. The compressor man could easily be dispensed with as he has virtually nothing to do but start the compressor in the morning and stop it at night. Even with this setup, however, it is believed that the actual labor costs for the jointing of any given piece of pipeline are little, if at all, higher than would be the case with hand-mortared joints. The material used is the same in both cases. The fee charged by the inventor for the use of the machine and for his own supervising services was an additional cost on this job.

Modern Power and Irrigation Structures Promote Development of North Africa

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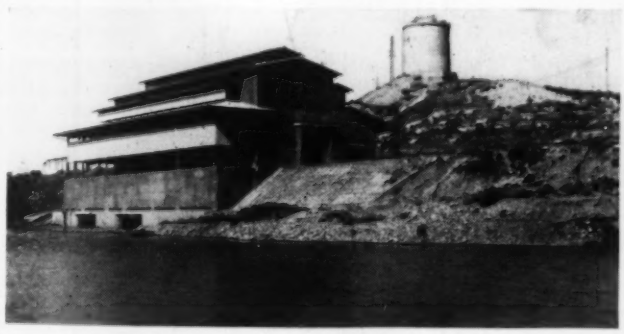
Consulting Engineer, Pittsburgh, Pa.

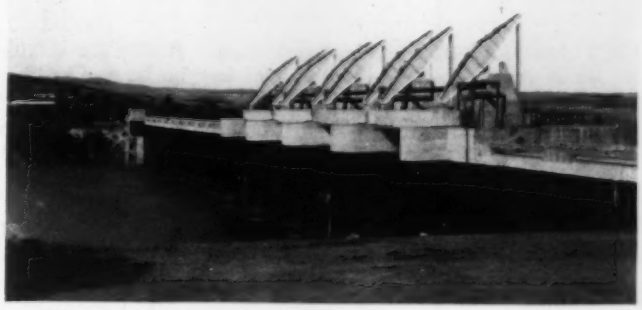
SINCE THE TIME of the Caliphs—during the sixth and seventh centuries—one of the culturally most highly developed human races of the world, the Arabs, has been populating North Africa and carrying its culture into Europe. Numerous magnificent structures belonging to that early period, some of them of highest artistic value, still cover North Africa. Notwithstanding its splendid past, North Africa, in recent years, has not kept pace with the fast development of other parts of the globe. Yet a country that was able to raise itself to a high state of human development during a time when power was supplied by human bodies, and supplemented by animals, should rise to even greater heights under the impetus of modern civilization, especially as represented in irrigation and power installations now in operation, under construction, or in the blueprint stage.

REINFORCED CONCRETE PENSTOCK, under construction, at Kasha Zidania hydro plant in Morocco on the Oum-er-Rbia, is type preferred to steel in North Africa unless heads are very high.

TWO SOURCES OF IRRIGATION water are available in North Africa. One is the visible supply that falls as rain or snow, mostly in the Atlas Mountains, and is discharged through rivers that flow to the Atlantic or the Mediterranean. The second is the invisible supply that passes from the Atlas Mountains through subterranean permeable soil strata. The former has been the source of water most widely used in past centuries and is the source that will be even more extensively used in the future. The latter is used extensively where water is sufficiently close to the surface to be readily available by pumping.

The Sahara Desert region furnishes the best known examples of communities whose existence depends on subsurface strata for their water supply. Probably the most striking example of such a community is the city of Marrakech, which is more or less an oasis surrounded by semi-desert. At one time it was the





KASBA ZIDANIA HYDRO PLANT in Morocco on the Oum-er-Rbia (left) is designed for hot climatic conditions with plenty of natural ventilation. Installed capacity is about 7,000 kw. Surge tank of very liberal dimensions can be seen in background. Lalla Takerkoust Dam in Morocco on the Oued N'Fis (right)—most southerly dam in French North Africa, located close to Sahara Desert—has installed capacity of about 11,000 kw. Automatic gates keep maximum elevation constant. Auxiliary dam below main dam makes it possible to generate energy during peak-load hours and yet retain water for uniform distribution into irrigation canals.

LATEST DEVELOPMENT IN MOROCCO is I'am Fout Dam on the Oum-er-Rbia. Completed during war, its first step was put in operation in 1944. Final development provides for raising of dam and building of second powerhouse with two Kaplan turbines of about 20,000 kw each.

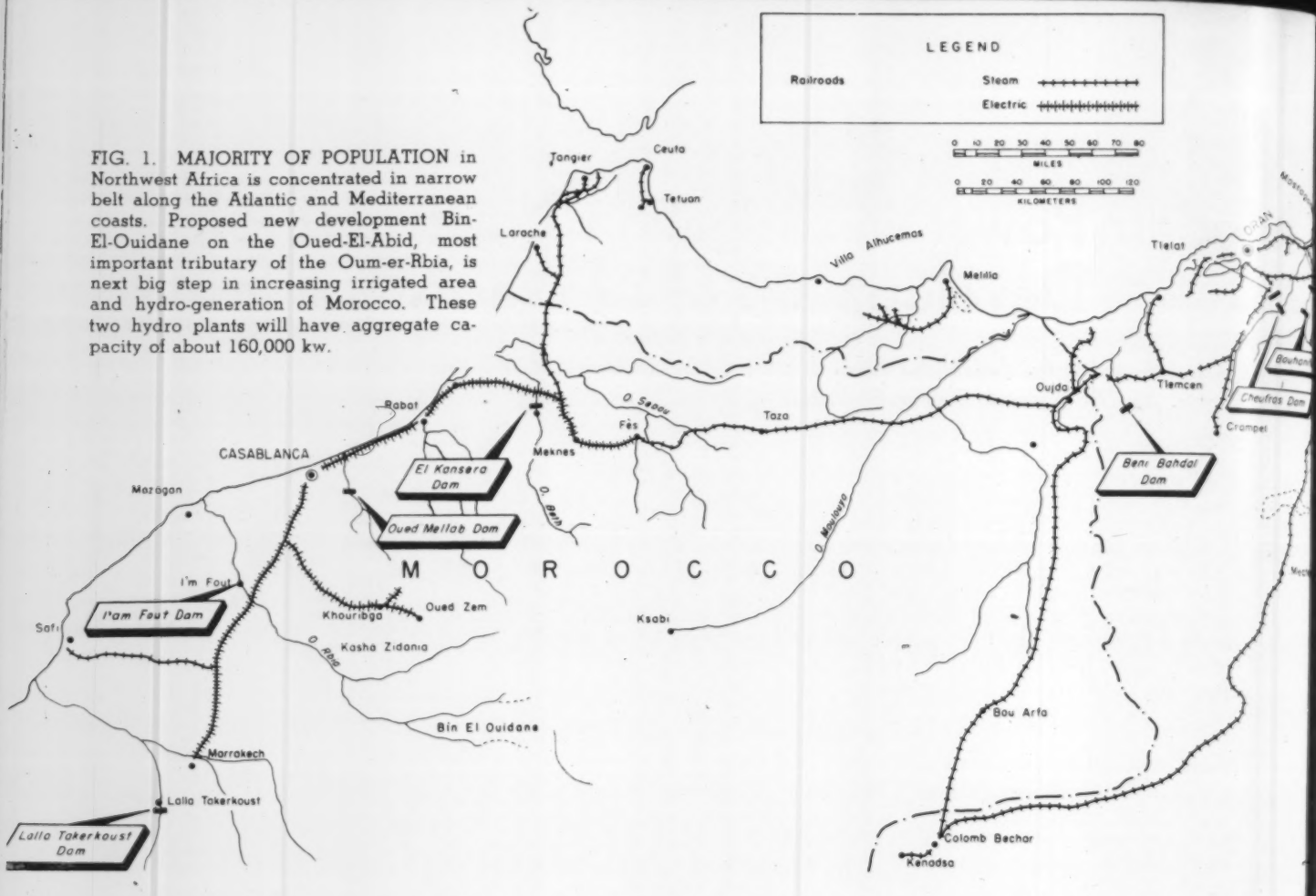


FIG. 1. MAJORITY OF POPULATION in Northwest Africa is concentrated in narrow belt along the Atlantic and Mediterranean coasts. Proposed new development Bin-El-Ouidane on the Oued-El-Abid, most important tributary of the Oum-er-Rbia, is next big step in increasing irrigated area and hydro-generation of Morocco. These two hydro plants will have aggregate capacity of about 160,000 kw.

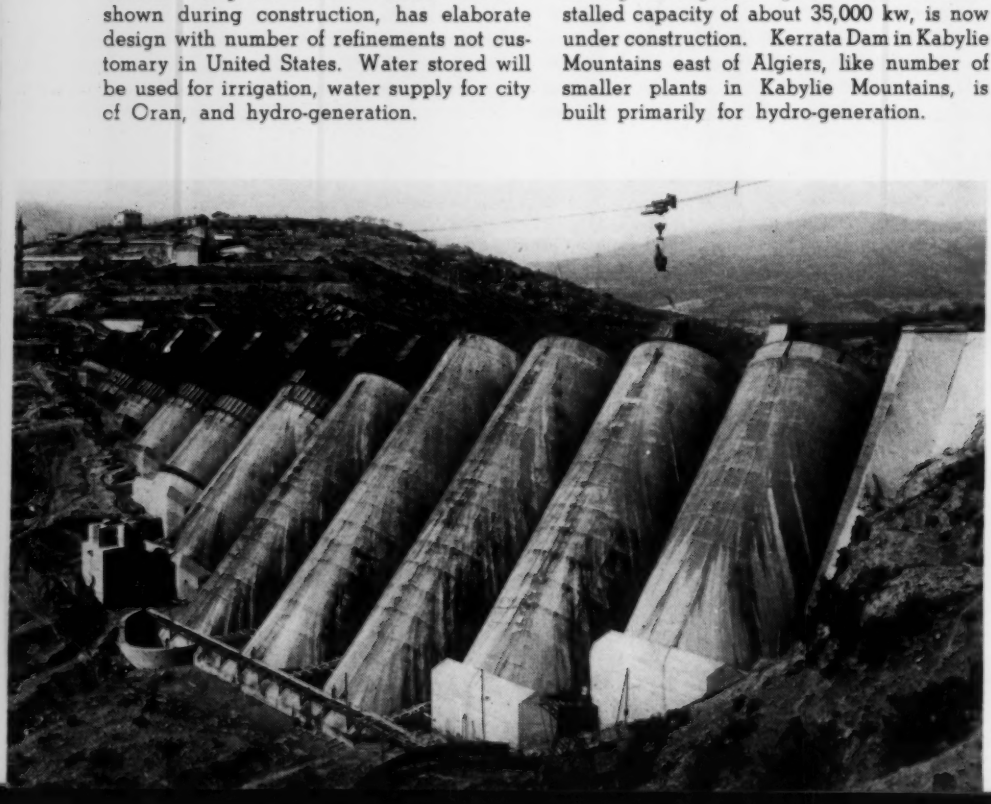
largest city in Morocco; and though it existed with so limited a visible water supply, it had extensive artificial ponds and lakes that were filled with water easily obtained from shallow wells. The amount of groundwater available in this locality is sufficient for truck gardening and extensive agriculture.

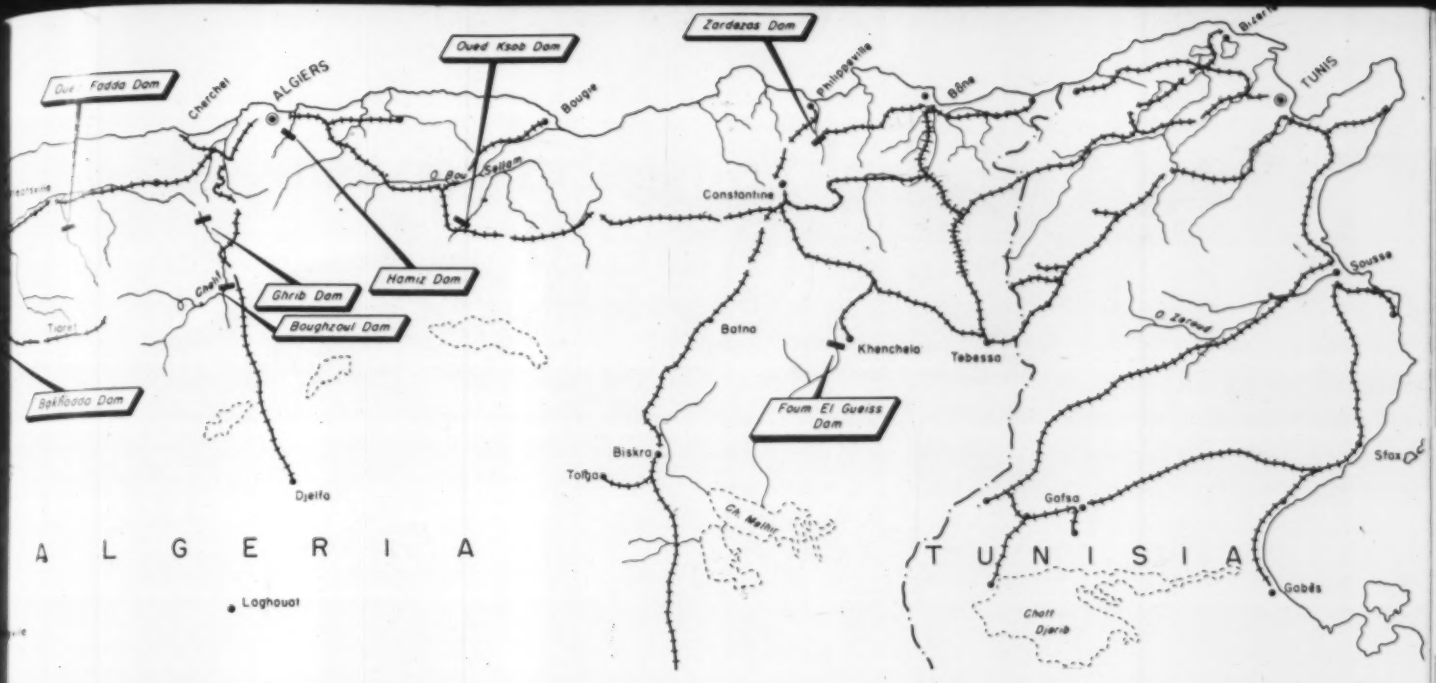
In other localities where the water is not as close to the surface as it is around Marrakech, it is pumped by means of animal power. Where soil conditions are favorable the countryside is dotted with small wells being circled by camels, horses or donkeys that work the primitive pumping arrangements. Some modern pumping equipment is used, particularly near large cities.

Irrigation is based on two radically different requirements. First, it is necessary to obtain supplies of water that can be directed to regions with favorable soil conditions. Second, salt water which contaminates low lands—some of the most fertile

FIRST AND LARGEST multiple-arch dam in North Africa (below)—Beni Bahdal in Western Algeria on the Oued Tafna—shown during construction, has elaborate design with number of refinements not customary in United States. Water stored will be used for irrigation, water supply for city of Oran, and hydro-generation.

FIRST STEP OF DEVELOPMENT that should be largest hydro plant in Algeria (right), having underground powerhouse and installed capacity of about 35,000 kw, is now under construction. Kerrata Dam in Kabylie Mountains east of Algiers, like number of smaller plants in Kabylie Mountains, is built primarily for hydro-generation.





MOST IMPORTANT of new Algerian dams, under construction or planned, are located near Tlemcen in the Department of Oran and in the Department of Constantine. Ambitious scheme in vicinity of Bône proposes draining of large salt-water marshes and irrigating with waters of the Bou-Namoussa, stored behind new dam. All these measures will nearly double the irrigated area of Algeria. In Tunisia development will go ahead as before, using small dams and large number of water wells.

areas—must be drained off and replaced by fresh water.

At present, irrigation and drainage are based on gravity flow. However, some pumping is done and quite an interrelation has developed between power generation, pumping and irrigation. A much more extended use of modern pumping equipment is probably one of the next major developments in the agricultural economy of North Africa, thus permitting the utilization of water from substrata too deep to permit its being raised by primitive pumping equipment.

If future installations include powerful electrical, gasoline- or diesel-driven pumps, many non-productive areas in North Africa may become highly productive. Sufficient quantities of water plus the two other essential factors, fertile soil and abundance of sunshine, will produce striking results in this arid country.

Water Rights Are Essential to Life

For several thousand years the existence of a large part of the native population depended entirely on the ability of various rulers to provide water for irrigation and to protect its source. A method of conducting warfare, favored by different tribes, was that of diverting water to force an enemy tribe to surrender or perish. With fears based on this historical background, native populations cling tenaciously to their water rights.

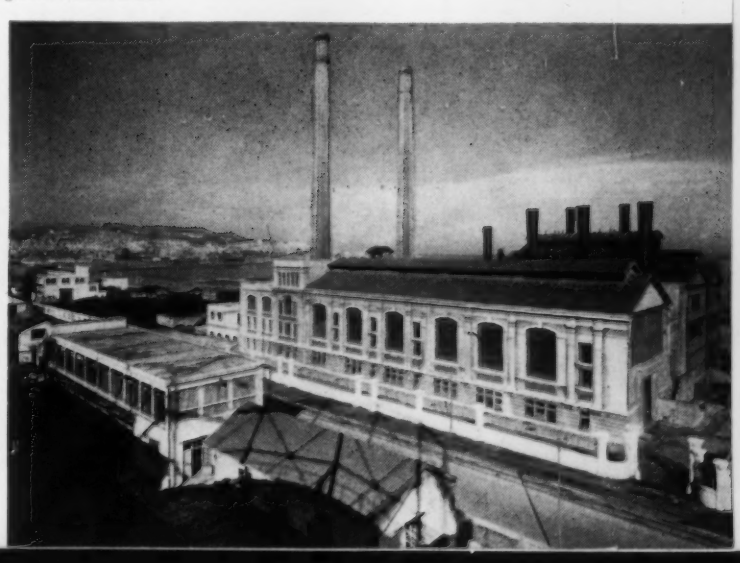
Water rights are based on many centuries of precedence closely interwoven with the interpretation of the Koran, as this Bible of Islam is not only a spiritual guide but also a set of rules for guiding the everyday life of a major part of the North African population. No matter how inefficient the distribution of irrigation water may be, it is exceedingly difficult to change the established water rights without causing a series of uprisings. The administrative policy evolved on the basis of these facts is to leave the distribution of irrigation water, whenever possible, in the hands of Arab councils. This policy is strictly adhered to in Morocco.

By building a number of dams to impound water, the French have provided entirely new sources of irrigation water, free from inherited rights. (See Fig. 1.) This water can be distributed and disposed of more efficiently and without danger of arousing the native population.

Water for irrigation is therefore, generally speaking, of two origins: (1) Old—the water being taken either directly from the rivers or from

WATER FROM RESERVOIR of Hamiz Dam and hydro plant on Hamiz River near Algiers—concrete gravity-type dam—is used mainly for irrigation purposes. Dam is one of oldest in Algeria. Built in 1883, it was rebuilt in 1934 to raise height 23 ft. and add small power plant (900 kw).

HAMMA STEAM PLANT in Algiers is largest in North Africa (60,000 kw). Induced-draft steel stacks, used in later additions instead of natural-draft brick chimneys of original installation, are evidence of plant's gradual evolution in keeping pace with increased power demands.



BEFORE AND AFTER VIEWS show: (Left) La Goulette steam plant in Tunisia after its destruction by retreating German Army on May 7, 1943. Turbine room, which contained units of aggregate capacity of about 40,000 kw, was almost completely destroyed; and (right) view of same plant in 1946, after restoration. Installed aggregate turbine capacity in 1947 will reach 52,300 kw in eight units.

reservoirs formed by ancient low dams and distributed in open canals and ditches; (2) recent—the water being taken from reservoirs formed by modern high dams and distributed through pipelines and concrete culverts to ditches of the ultimate consumers.

In constructing numerous modern dams, particularly in Algeria and Morocco, the French administration has performed a remarkable service in regulating and controlling river flows and providing seasonal irrigation. In Algeria, based on an average water supply over the whole year, about 600 cfs are made available by modern reservoirs. In Morocco, out of an estimated total of about 700 cfs used for irrigation, about 175 cfs are supplied from reservoirs formed by recently built modern dams. The remaining 525 cfs are supplied by the ancient water systems.

Railroads Electrified

Irrigation, transportation and power are closely interwoven. This is particularly true in Morocco where a large part of the power is generated by hydro-plants at dams constructed primarily for irrigation. The absence of any local source of fuel for locomotives and the scarcity of boiler feedwater has resulted in electrification of nearly 70 percent of the railroads in Morocco. A large part of the hydro energy developed in Morocco is therefore used for railroad transportation.

Because of topographic features peculiar to this region, most irrigation dams are built at comparatively high elevations and the water is used on plateaus at much lower levels. It is therefore possible to use the water for generating power before directing it into irrigation canals. A number of dams built primarily for power purposes provide substantial quantities of water for irrigation.

Topography and rainfall conditions in Morocco provide the greatest hydro-power potentialities in French North Africa. In Algeria there are numerous hydro-power sites but the aggregate possible capacity is substantially lower than that of Morocco. Tunisia has practically no potential hydro power.

The growing importance in modern times of other economic factors such as transportation, and particularly power, as compared with irrigation can be seen in the improved power and transportation facilities and in the rapid growth of coastal cities like Casablanca, Oran, Algiers, and Tunis. With its recent rapid growth, Casablanca has forged ahead of Marrakech to become the largest city in North Africa.

The trend in power development before the war was toward covering French North Africa with adequate transmission systems to distribute power generated by major steam-power plants located at strategic points along the sea. Development of thermo-power generation has been based on the availability of an adequate fuel supply from abroad.

Development of hydro sites in various sections of the country is evidence of the determined effort to remove, at least in part, the dependence on foreign fuel for power. The whole program has been laid out as a long-range proposition. Substantial steam generating capacity given to the French government by the Germans under the terms of the Versailles Treaty was diverted to North Africa, to Algeria in particular. A few localities in Algeria are actually oversupplied with steam generating capacity, having a surplus sufficient to take care of power demands of industrial development for a number of years.

Large Power Plants Along Coast

Many of the large-capacity steam plants along the seashore in Casablanca (Roches Noires), Oran, Algiers, Philippeville, Bône, and Tunis (La Goulette), which in the past were operated on high-quality English coal, have changed to oil. A number of small diesel-engine plants along the seashore in Bougie, Bizerte, Sousse, Sfax, and Gabes, and inland in Constantine, Souk El Arba and a number of other places receive oil from abroad.

A number of hydro-plants in Morocco and Algeria—in the latter country mainly in the Kabylie Moun-

(*Continued on page 82*)

Engineering Education Includes More Than Basic "Three R's"

GEORGE H. HARDING, ASSOC. M. ASCE

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"WHAT IS EDUCATION?" It might be said that education consists of the acquisition of knowledge and the ability to intelligently use that knowledge. Education may be accomplished, or knowledge may be acquired, by formal means through courses presented by schools and colleges, by self study, by experience, or by any combination of these means. A college degree does not necessarily indicate a measure of intelligence, nor does the lack of a college degree necessarily indicate the opposite. Certain outstanding men in the engineering profession have acquired their preeminence through self study and experience and without the benefit of formal education. Too often, what might be termed the "educational cast system" has discriminated against those individuals who have acquired their knowledge by other means. Both as engineers and as members of society, we should insist on the recognition of ability and the possession of knowledge and be less concerned with the degrees which an individual may or may not have.

EDUCATION INVOLVES many factors other than those ordinarily acquired in the classroom. The "Three R's" used to be considered the basic foundation of education. In spite of the trend of "modern education," it might be well to retain these fundamentals and add certain essential intangibles. In years gone by the home and its training was an indispensable part of our American educational system. Two world wars and accompanying economic upheavals have tended more and more to place the entire responsibility for the training of our youth upon the educational system. The result is evidenced everywhere throughout the country by the enormous increase in juvenile delinquency which is now getting widespread attention in our press and pulpits. This attitude of disregard for the generally accepted standards must, of necessity, carry over and be demonstrated in the lives of older generations.

Two possible courses seem obvious. Perhaps the real solution must be a combination of the two. The fundamentals of human behavior *must* be taught in the home. This is obvious, although outside the province of this discussion. In addition, these fundamentals should be included within the framework of our educational system and taught both by precept and, more important, by example.

Perhaps we might add to the original "Three R's," intangibles which we might call the "HCL's."

First, HONESTY, not only in dealing with others but in appraising ourselves. Honest consideration and decisions based upon the rights of others, honest study of all sides of any controversial problem and then a sincere decision based on the known facts of these, would go far to eliminate much of our industrial strife and many of our labor problems.

The second, COURTESY, is fighting a losing game both in the classroom and in homes throughout the country. The lack of courtesy is increasingly evident. Perhaps this seems unimportant until you consider a recent report on highway accidents for the nation which stated that 75 percent of the accidents would never have occurred if the drivers had practiced accepted courtesy. Courtesy or the lack of it may cause misunderstandings between individuals. National courtesy or its lack may either promote good will among nations or may cause difficulties which may well spell the difference between peace and war.

The third, LOYALTY, is a characteristic which has been given many definitions in the past. Loyalty, like honesty and courtesy, can best be accomplished and practiced reciprocally. Any employer has the right to expect loyalty from his employees, and, equally important, every employee has the right to expect the same degree of loyalty from his employer. This holds true in any type of organization whether it be civil or military if that organization is to have an "esprit de corps" which will carry it through difficult times.

Engineering education might be termed the acquisition of knowledge with the ability to use it intelligently in order to economically and efficiently utilize materials and forces or power. You will no doubt agree that an engineer not only should have

ECONOMICAL AND EFFICIENT use of materials and forces, as exemplified by many large projects now under construction, is basis for engineering education. Shown here is Merriman Dam, 12,500,000-cu yd earthfill structure near Lackawack, N. Y., in Catskill Mountains. Core fill along side concrete core wall is leveled off by D8 tractor equipped with bulldozer, and two motor graders prior to compacting by sheepsfoot tampers. Reservoir—7 miles long and mile wide—will store 51 billion gallons of water. Underground tunnel will carry water 85 miles to New York City.

BASIC "THREE R's" and intangible "HCL's," as explained in text, help engineers meet obligations to society in performance of tasks for which they are trained. Pictured here is work in progress on overpass (background) on Taconic State Parkway route from New York City to Canada. Roadbed for N. Y. Highway 55 in foreground is prepared by Caterpillar grader with scarifier attachment, R4 tractor-dozer and shovel that loads stripped material into trucks.

within him a background generated by the basic "Three R's," but equally as important, should include within his makeup the intangible "HCL's." The engineer, like any other professional man, has a distinct obligation to the society of which he is a part. He can best perform those obligations when his training has included the fundamentals just mentioned.

We might consider the question, "What should be the relation of engineering education to research?" I have felt often that a direct analogy exists between the period of internship prior to the practice of medicine and a period of experience in industry prior to teaching. Both give members of their respective professions the opportunity to apply directly the lessons learned in the classroom and from the textbooks. This practical experience is to my own mind indispensable as a background for efficient teaching efforts. Assuming that the teacher in engineering has acquired his practical experience in his own particular field in industry, private practice, or elsewhere prior to entering educational work, it is still necessary for this individual to keep abreast of new developments being made in his field.

Normally, under our present educational system, it is not practicable for the teacher to return to industry at periodic intervals. Therefore, the only practicable way for him to keep out of a "mental rut" would be to engage in part-time research along with his teaching work. Of course, there are other ways in which this individual can facilitate his own improvement. Our professional societies, both national and local, attempt to do this through their meetings and periodicals. The writer is convinced, however, that to the average man, this reading and listening alone is not sufficient. It is an accepted educational fact that we learn best by doing.

Relationship to Profession

You might ask the question, "What should be the relationship of engineering education to the profession itself?" The sole purpose of any professional education should be to *improve* the existing standards of that profession, to simplify procedures and to develop more efficient techniques. This has a direct relation to industry in the engineering field because the development of techniques and equipment must, of necessity, follow closely. The profession and industry should, therefore, have a real and deep interest in the educational system which is producing the men for their particular field. On the other hand, engineering educators should be deeply concerned with the problems of industry and the profession of which their graduates will become a part upon leaving college. Again, this calls for mutual cooperation and mutual understanding. Professional societies are, for the most part, made up of former products of our engineering educational institutions. Therefore, their interest in those institutions should be real and active, not only from the standpoint of maintaining professional standards but, more important, from the standpoint of improving those standards. Any deterioration in standards reduces the value of the investment made, in time and effort as well as money, in acquiring that education.

What Can Be Done?

With these previous questions and their accompanying comments in mind, let us ask ourselves the question, "What might be done to improve and facilitate the process of engineering education?" As engineers, you would not accept for use in a structure, steel which had not been tested to meet certain specifications. Nor would chemicals be accepted for the manufacture of some product which did not meet the specifications governing their purity or concentration. Our process for the selection of human material (students) for engineering educational institutions, as generally practiced, is most haphazard.

The writer has had the interesting experience in the past of conducting experiments for some nine years, in an attempt to determine means by which this choice of human material could be accomplished more effectively. It has been proved, to the writer's own satisfaction and to the satisfaction of the institution at which he was then located, that a combination of tests could be established which would predict, with a minimum accuracy of 90 percent, the student's scholastic achievement within the engineering course in that institution. Those tests were adopted and now form a part of the admission requirements to that engineering school. However, although this procedure has reduced the mortality rate among entering engineering students to an extremely low figure, this is not the complete answer. It was the writer's contention then, and is now, that a series of tests for other fields of endeavor could be devised over a period of time and actually checked against scholastic performance. These tests would be of such a nature that they could be presented to students at the end of the third year of high school, not to weed out individuals who are not fitted for a particular field, but rather taking the positive view, that a series of tests, covering many lines of endeavor, will determine in which of these fields the student has the greatest chance of success.

Another suggestion might well involve a closer cooperation between

the profession, industry and the educational institutions. No course or series of courses presented at an educational institution should be fixed. They should always be considered as in a state of flux, subject to change and constant improvement. The educational institutions might do well to invite advisory committees composed of representatives of the various fields within any profession to meet periodically, examine the curricula presented, and make recommendations to the educational institutions, together with supporting arguments for such changes. Most professions are changing constantly. Sometimes this change is slow, sometimes rapid, depending upon the rate of new development within the field. In most cases the outstanding professional men would consider it a service to their profession to serve on such advisory committees.

Another suggestion might be the inclusion, within engineering educational institutions, of short-term courses which are designed to bring up to date with new developments, graduate engineers who do not have the means to leave their jobs for regular college courses, in order to be informed on the latest developments in techniques and equipment. These short-term courses might well be worked out as a combination of efforts of the educational institution, professional societies and industry itself.

Another suggestion might be to increase the efficiency of operation of our engineering educational institutions. Since normally the primary functions of an engineer are to apply efficiency and economy to some operation, it should be reasonable to expect that the educational institution at which he receives this training should *demonstrate*, so far as is possible, and not only *teach* these principles of efficiency. Throughout the country at large, one will find that many of our engineering educational institutions have become involved with red tape, institutional and departmental politics, indirect petticoat government, and other factors of which the student cannot help but be cognizant, which tend to nullify the principles of efficiency and economy as taught.

Administrators and Instructors

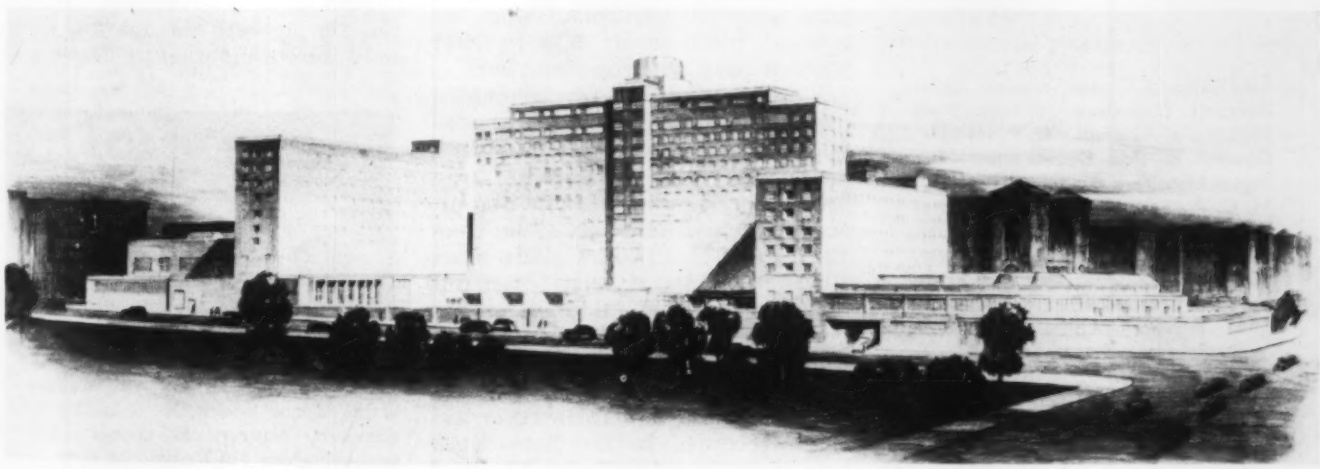
Perhaps a suggestion concerning the selection of individuals for administrative and teaching positions in engineering educational institutions would not be amiss. An administrator or instructor should possess, in addition to the required basic educational requirements *and the "HCL's,"* the following characteristics:

(1) A real interest in, as well as thorough knowledge of, his specific field as well as a general knowledge and sympathetic attitude toward related fields; (2) enthusiasm for his field as well as the ability to impart, to some extent at least, this enthusiasm to both students and others with whom he comes in contact; (3) a real desire and constantly applied effort to improve all of his courses and their presentation; (4) the ability to readily impart his knowledge, by lecture and demonstration, to students in his classes; (5) physical, mental, and moral qualities which command the respect of both students and associates; (6) the desire and ability to cooperate freely with others, both within and outside of his own institution in all matters that will improve the status of the profession; (7) last, but not least, the ability of leadership and organization.

Perhaps few humans combine all of these attributes, and certainly not to the same degree, but certainly these characteristics should be sought for, acquired whenever possible, and encouraged at all times.

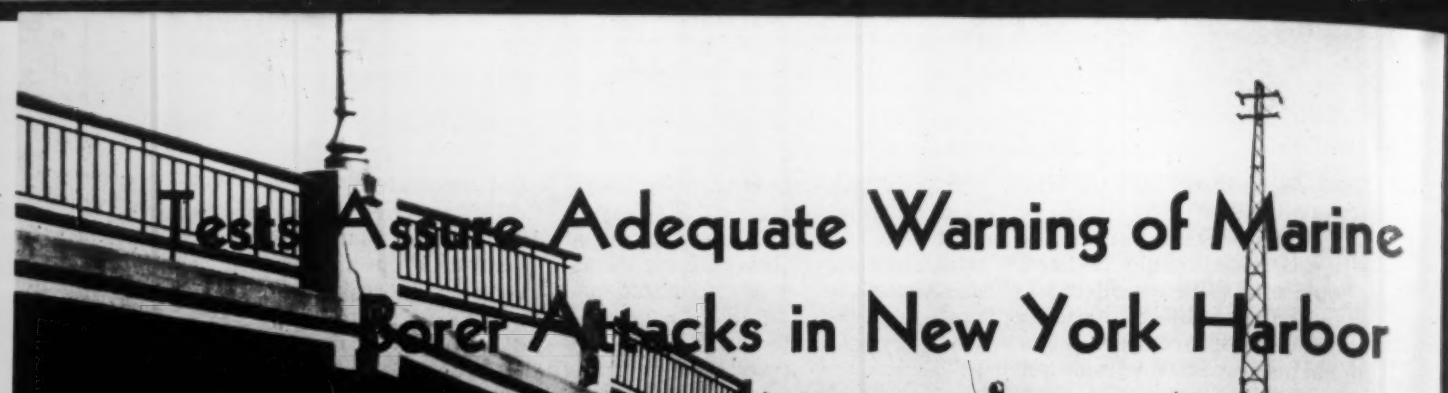
Now as to my last suggestion, generally speaking there is no real attempt made within our present engineering curricula to develop the qualities of leadership, personal initiative and responsibility. The average student completing his engineering course has been told what to do, how to do it, and when it must be done, during the greater part of his technical training. Yet this training is supposed to have given him the necessary basic background for his profession, the principal requirements of which include, in addition to technical qualifications, leadership and responsibility. A course cannot be set up for the sole purpose of developing these qualities; however, existing courses can be so set up or rearranged as to enable the qualities mentioned to be developed.

The manner in which these qualities can be included as an important part of certain courses will differ, depending upon the course itself, the location of the institution and the interest of the teaching staff. My own experience has proved that efforts made in this direction are well worth while and very gratifying.



TO ASSURE ECONOMICAL CONSTRUCTION, new $8,000,000 Residence and School for Nurses, Bellevue Hospital, New York City, is based on modular planning, making full use of dimensional coordination for materials used. Reinforced concrete structure employs cavity wall system throughout. Project designed by Alfred Hopkins & Associates, Architects, will occupy entire city block. Structural engineering design is by Fred N. Severud, M. ASCE, New York City. Borings have been made at site and construction is scheduled to begin late this year.

Tests Assure Adequate Warning of Marine Borer Attacks in New York Harbor



WILLIAM F. CLAPP
Director, W. F. Clapp Laboratories and Consultant to Marine Borer Research Committee of New York Harbor

Photo, Courtesy "Newark Evening News."

ESTIMATES INDICATE that damages resulting from marine borer activities cost the United States $50,000,000 annually. Although damage to wharf structures in New York Harbor has been slight in recent years, the possibility of increased activity is recognized. To insure adequate warning of possible attacks, the Marine Borer Research Committee of New York Harbor was organized in 1938 to secure the cooperation of a number of organizations, governmental and otherwise, in collecting test data for laboratory analysis. This work, as described herein by Dr. Clapp, is the subject of the committee's Third Progress Report published recently by the Port of New York Authority for distribution to those concerned with marine borer research activities. By presenting the results of its eight years of activities, the Marine Borer Research Committee of New York Harbor hopes to stimulate similar research in other harbors.

RECORDS BASED ON laboratory analysis of approximately 8,000 individual test blocks from New York harbor over an eight-year period indicate that there has been no serious Teredo activity within the inner harbor, which includes Upper New York Bay and the waterways surrounding Manhattan Island where the waterfront development is most intense. These same records show that the activity of Teredo Navalis over the entire New York area—the inner and outer harbor and Long Island Sound—had an upward trend from 1938 to 1941 when a peak was reached.

Teredo activity showed a sudden drop in 1942 and virtually disappeared for a period of several years. In 1946, light attacks again appeared. Similarly, Limnoria attacks showed an upward trend from 1938 to 1941. In the years since 1942 and at present, activity remains at a low level. To date, there has been no evidence of Chelura or Martesia attacks in New York harbor.

The trends in marine borer activity recorded in the New York area appear to be almost identical with those observed at other points along the Atlantic coast. In New York, the salinity of the waters normally varies from a low percentage in the Hudson River to a high percentage approaching that of sea water in the outer harbor. During high runoffs of the Hudson River, however, salinity percentages are reduced. Records indicate less marine borer growth in waters where salinity is normally low, as in the waters of the Hudson River above 125th Street.

Part of the food supply necessary for the growth of marine borers may be brought into New York

OFFICERS OF the Marine Borer Research Committee of New York Harbor are: Chairman, W. P. Hedden, Director of Port Development, The Port of New York Authority; secretary, H. C. Ames, manager, Department of Piers, United Fruit Co.; treasurer, F. C. Kronauer, division engineer, New York, Susquehanna & Western Railroad Co. Members of the Technical Advisory Committee include Seth G. Hess, M. ASCE, director and chief engineer, Interstate Sanitation Commission; R. H. Gould, M. ASCE, director, Division of Engineering, New York City Department of Public Works; Lewis H. Rabbage, chief engineer, New York City Department of Marine and Aviation; and R. H. Wuestefeld, engineer, U.S. Engineer Office.

COLLAPSE OF BRIELLE BRIDGE over Manasquan River between Brielle and Point Pleasant, N. J., last year is graphic evidence of destructive nature of marine borer activity. Weakened by repeated attacks of Teredo and Limnoria, center pier supports gave way as pictured here. Draw span, beside control house on bridge, is blocked by buckled span. Photo, courtesy "Newark Evening News"

TEREDO, MEMBER OF CLAM FAMILY, is one of most destructive of marine borers, although, contrary to popular view, it probably does not burrow for food but for protection, and is dependent on supply of micro-organisms in sea water. Two detached shells (center, right), part of Teredo head, are used as boring tool. Two pallets (center, left) in tail are used to close tunnel entrance for protection if necessary.

harbor by the Hudson River, and part may be developed by the conversion of organic wastes in the harbor. One major change in natural conditions that may occur in the future is a decrease in the pollution of harbor waters resulting from the sewage treatment program, which may affect the amount and character of secondary products available for food supply.

Sewage pollution will be removed gradually, according to present indications, in a program extending over a number of years. It will be possible, therefore, to observe the resulting changes in marine life and to correct and guard against any adverse trends. The committee plans to continue the program of exposing an adequate number of test boards and analyzing the data thus obtained so that timely warnings can be issued if marine borer activity is found to be on the increase.

Of the countless organisms that are normally present in sea water, two main groups concern the owners of marine properties—destructive marine borers and fouling, or associated, organisms. The marine borer group includes the many varieties of marine mollusks and crustaceans capable of boring into timber and those few forms that can drill into shale, limestone, marble and poor-quality concrete. No wood is entirely immune from borer attack.

The second group, the fouling organisms, is composed of the many organisms that become firmly attached to and grow rapidly in size on ships' bottoms, on piles, in intake tunnels and in other marine structures. A collection of these organisms that would scarcely fill an ordinary bucket when first set, may weigh 296 tons at maturity.

The presence of fouling organisms has proved an excellent indication of conditions favorable to marine borer growth. Where only a few specimens of one or two species of fouling organisms are present, it is almost certain that marine borers will not occur. On the other hand, where fouling organisms are plentiful and many species are represented, it is certain that there the borers, if present or if introduced, will be destructive. It is for this reason that the fouling organisms have been termed "associated organisms."

The important marine organisms which, so far, have appeared on the Clapp Laboratory's test boards have been grouped as follows:

Marine Borers:

Teredinidae (Teredo, Bankia, Lyrodus etc.)—shipworms
Pholadidae (Pholas, Hiata, Martesia, etc.)—boring clams
Crustacea (Limnoria, Chelura, Sphaeroma)—boring pillbugs

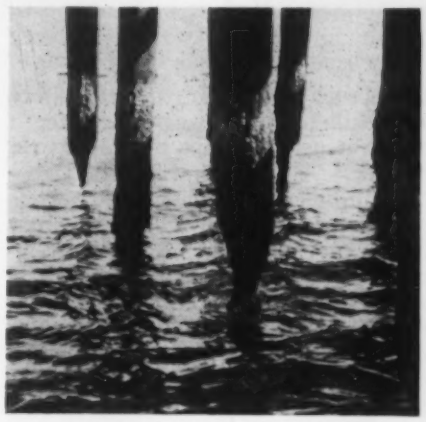
Fouling Organisms:

Algae (seaweeds)
Coelenterates (corals, seaflowers, sea grasses)
Filamentous Bryozoans (sea moss)
Encrusting Bryozoans (calcareous coral-like patches)
Annelids (tube worms)
Crustaceans (balanus), barnacles
Mollusks (mussels, clams, oysters)
Tunicates (sea squirts)

The most common marine borers are described as follows:

1. **Teredo Navalis,** the most common and dangerous of the molluscan marine borers, looks like a worm with teeth but is really a relative of

LIMNORIA, CRUSTACEANS RESEMBLING PILLBUGS (above), can cut off untreated piling in two to three years. In New York harbor activity of these organisms has been at low level since 1942. Effect of pollution-abatement program is being closely watched.



NORTHERN WATERS ARE NOT SAFE from Limnoria and Teredo attack, as these piling structures (right) from Narraganset Bay, Rhode Island, prove. Once borers have entered wood, effect of water temperature is greatly reduced.

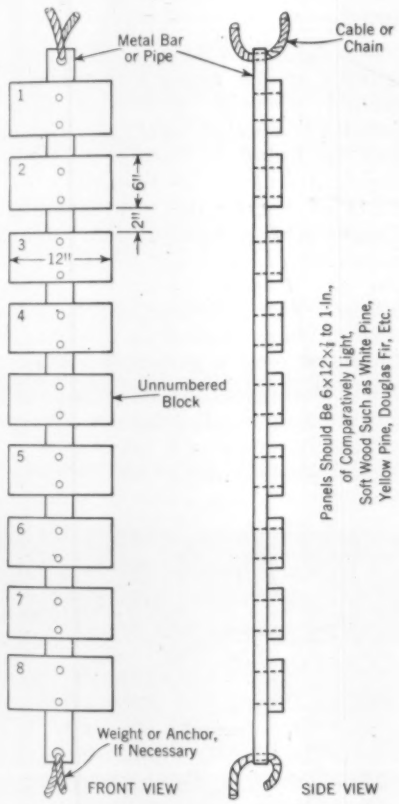


FIG. 1. WOODEN TEST BLOCKS, attached to metal bar or pipe and hung about 2 ft above mud line, provide place for marine borers and associated organisms to lodge. Blocks are detached at regular intervals for study at Clapp Laboratories, Duxbury, Mass.

NEW YORK HARBOR suffers little from borer attack, but Teredo is active at nearby Fire Island, as indicated by timber pile section (left). Sea Anemone or Metridium (center) may reach both length and diameter of 5 in. Where such fouling organisms are plentiful, marine borers also thrive. Three pile specimens (right) show typical marine-borer damage: (A) Pile cut between medium and low tide after three years of service, Mississippi; (B) result of two years of Limnoria activity; (C) combined action of Limnoria and Teredo.

the clam family. In its head there are shells having rows of sharp teeth which it uses as rasps to tunnel into timber. At the end of its free-swimming period, the teredo settles on any object with which it comes in contact. If the object is rock, sand or mud, the chances for its survival are slim. If it settles on timber, however, the borer immediately tunnels its way inside, rapidly opening and closing its shells to carve out its route. The two pallets located in its tail are used to close the entrance to the tunnel for protection when necessary.

2. **Martesia** is a boring clam which is highly destructive. It grows to a length of 2 in. and a diameter of $^3/_4$ in. and makes a burrow of its own length in about one year. Wood heavily attacked by it disintegrates so rapidly that the diameter of a pile may be reduced by 4 in. in one year.

3. **Limnoria,** a crustacean variety of borer, looks like a pillbug and grows to a length of only about $^1/_8$ in. By chewing away the wood ahead of itself, it is able to make a shallow burrow seldom longer than $^3/_4$ in. Its small size is deceptive, however, as destruction of the timber is progressive, each disintegrated layer exposing a fresh surface to attack. Actual observations show that a pile may suffer a loss of 2 in. in diameter a year from Limnoria attack.

4. **Chelura,** another variety of crustacean, is quite similar to Limnoria in size, but resembles a miniature lobster in appearance. It is found along the Atlantic coast, usually with Limnoria. Recent research indicates that it is not as destructive as had been previously reported.

Factors Affecting Marine Borer Growth

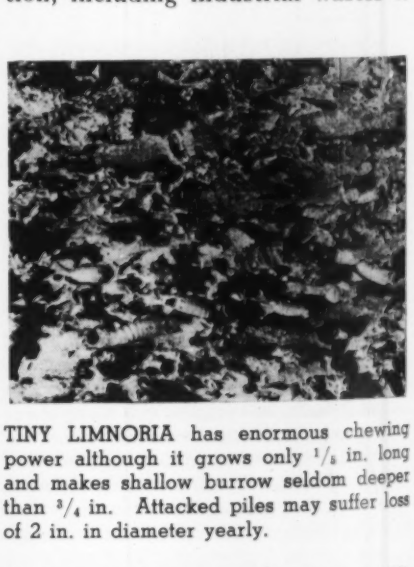
Exhaustive studies in connection with test-board analyses have been conducted for many years in an effort to determine the likelihood of marine-borer activity at specific locations. It has been learned that conditions generally are more favorable for marine borers where water temperatures are high during the breeding season; where the salinity is not far below that of normal sea water; where the dissolved oxygen and hydrogen-ion content are high (a hydrogen-ion concentration lower than 7 on the acid side is usually an indication of heavy industrial waste or other heavy pollution); and where the food supply is plentiful. Where these essential factors are lacking, marine borer activity will be curtailed.

Several of these factors were at one time believed to explain the annual variations which occur in marine borer growth. However, research at the Clapp Laboratories indicates that such factors influence the situation chiefly through their effect on the borers' food supply. The effects of these factors on borer activity are discussed in the following paragraphs:

1. **Temperature.** Careful correlation of temperature records with marine borer growth shows that this growth is only slightly affected by considerable variations in water temperature during the seasons of borer activity—spring, summer and fall. The only exception occurs in Nova Scotia waters where, during the short breeding season of one or two weeks, the water may not become warm enough for survival of the borer embryos. The analyses also revealed that once the borers have entered wood, any effect of water temperature is greatly reduced.

2. **Salinity.** At one time, the salinity of the water was also considered a vital factor in borer activity. Heavy sets of Teredo may be found in harbors having a constant salinity of from 20 to 30 parts of total salts per thousand. Recent studies have revealed that a variation of 10 parts per thousand has no marked effect on marine borers. Few harbors have a variation of more than 2 or 3 parts per thousand over a period of years.

3. **Pollution.** It is certain that marine life of all kinds is affected adversely by certain types of pollution, including industrial wastes or



TINY LIMNORIA has enormous chewing power although it grows only $^1/_8$ in. long and makes shallow burrow seldom deeper than $^3/_4$ in. Attacked piles may suffer loss of 2 in. in diameter yearly.

oil in addition to sewage. However, it appears that pollution is not responsible for the annual periodic variations in marine-borer activity in any particular location. Such variations are produced even where the amount of pollution varies only slightly from year to year—as is the case in practically all harbors.

No measurable change in marine life has been found in harbors where radical "purification" programs have been undertaken. However, in one instance, where *all* the treated sewage effluent was carried outside the harbor, there was a sharp increase in borer activity. Where a "purification" program is limited to one or more types of treatment, and where the discharge still contains industrial wastes, oil, and possibly additional chlorine, there has been no evidence of any increase whatever in destructive marine organisms.

4. **Food Supply.** Many students of marine borer life have published data to indicate that the borers tunnel into wood to obtain food. However, studies made at the Clapp Laboratories do not support this finding for the following reasons:

Like the Teredo, or shipworm, the common or soft clam of the Atlantic coast is a bivalve mollusk. It inhabits deep burrows in mud and sand flats but does not obtain food from the mud or sand in which it burrows. Rather, the clam obtains its food by means of a syphon extending from its body up to the entrance of the tunnel, where it is in contact with sea water containing the diatoms and other micro-organisms on which it feeds. None of the marine bivalves that drill in mud, sand or rock are dependent for food on the material into which they burrow. It therefore seems illogical to believe that the Teredo is an exception to this rule.

If the Teredo lives on micro-organisms in the water, rather than on timber, the yearly variations in its activity might be accounted for on the basis of an abundance or scarcity of food. For example, it is known that oysters are poor in years when their food supply during the growing period is limited, and conversely that they thrive in years of abundant food supply. Published records indicate that in abnormally dry seasons, oysters are undernourished. On the other hand, they thrive in years of heavy rainfall, when the streams carry into the harbors a vast supply of microscopic food.

It seems logical to believe that the same factor that causes favorable or unfavorable seasons for the oyster also accounts for unpredictable yearly variations in the activity of the Teredo and other molluscan borers.

LOBSTER-LIKE CHELURA (left), formerly considered one of most dangerous of marine borers, is now believed to be much less destructive. Annelids, or tube worms (right) are fouling organisms that may accelerate corrosion of metal. Worms may attain length of several inches.

This conclusion is strengthened by data secured on the lower Hudson River, above 125th Street, New York City, during a recent unusually dry season. In this section of the river, salinity is normally too low to support more than a few scattered and exceptionally hardy shipworms. It is reasonable to assume that the increased salinity caused by the decrease in the river's fresh-water flow would provide more favorable conditions for the borers. However, fewer marine borers appeared than in previous years and it was learned later that oyster beds had also suffered.

It therefore appears that food supply is the important factor governing marine-borer activity. Such factors as temperature, salinity and pollution do not affect the borers directly, but rather indirectly since they influence the supply of micro-organisms on which the borers depend for food.

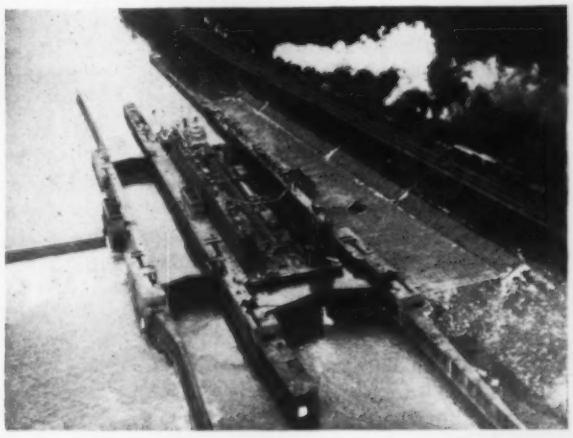
Test Board Procedure

Altogether 44 test boards are now maintained in well-distributed locations throughout the New York area by 18 companies and governmental agencies. These boards, by providing a place for marine organisms to lodge, are the means of determining the number and types of organisms present at each location. From each of these boards, blocks are removed every month and sent for analysis to the Clapp Laboratories at Duxbury, Mass. This permits the prompt discovery of any borer

(*Continued on page 84*)

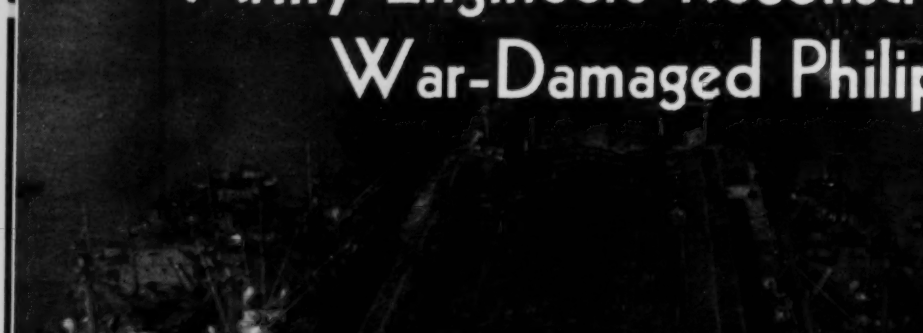
Large Drydock Passes Through Ohio River Locks

LARGEST VESSEL ever launched on inland river, 6,000-ton floating drydock, is maneuvered into Dashields Locks on Ohio River below Sewickley, Pa. Recently completed at Neville Island Yard of Dravo Corporation, Navy AFDL-47 is towed 2,000 miles to Gulf of Mexico. Huge drydock, with over-all dimensions 448x97 ft, has but 6½-ft clearance either side as it passes through lock. Unit will supply additional mobile drydock facilities as Navy preparedness measure. Drydock includes crew quarters designed for 130 men and 7 officers.



Army Engineers Reconstruct and Expand War-Damaged Philippine Ports

CHARLES L. HALL, M. ASCE
Colonel, Corps of Engineers, U. S. Army



REPORTED TO BE FINEST in Orient prior to war, Pier 11 South Harbor, Manila, is 228 ft wide by 1,290 ft long with 110-ft approach section. Partly restored pier is utilized to utmost degree. Ships carrying urgently needed materials and unable to berth unload on lighters and barges while other ships anchor in harbor and await their turn to unload. Navy salvage crews removed 40 wrecked vessels of all types from Manila Harbor but many still remain.

IN THE FALL OF 1945, Colonel Hall was sent to the Philippine Islands as head of a group to prepare plans and estimates—within 60 days—for the rehabilitation and reasonable expansion of Philippine ports. His report has been printed recently as a Senate committee document. The publication of that report makes it now proper to present a technical paper on the subject. The paper describes an unusual method of field examination and a difficult problem in cost estimating. Colonel Hall's description of the effects of modern war on the shores of the Philippine Islands is a necessary introduction to his story that follows on the task that faced the American government in its aims to heal some of the wounds of war.

DESTRUCTION DURING the Japanese invasion of 1942 was small. The Japanese captured the tiny American garrisons, and took over the interinsular sea routes and their terminals. The native population was bitterly hostile, and Japanese control never extended much beyond the garrisoned towns. Control of navigation made it possible to govern and to exploit the islands with a comparatively small force. Sea control by warships was supplemented through sea control by planes.

The American counter-invasion of 1945 was both preceded and accompanied by a successful attempt to disrupt the interinsular routes, mostly by air, though partly by submarine. Ships and wharves were repeatedly attacked. Japanese units were isolated logistically and to a considerable extent tactically, so that instead of attacking the archipelago our troops merely had to attack successively the various islands. In Mindanao and southern Luzon, where land routes were rudimentary, they could isolate sectors of islands. Needless to say the military activity resulted in a great deal of port destruction and many sinkings in navigable channels.

Engineer's Nightmare

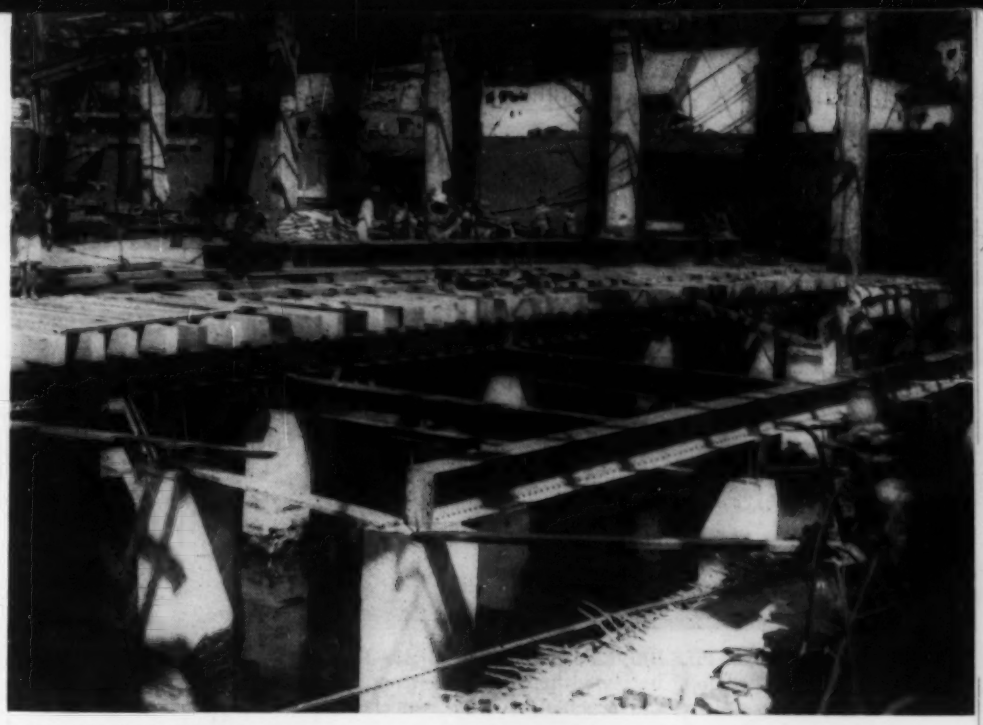
Manila was in a slightly different situation. From the capitol city, good land routes extended for many miles, and the port was protected from direct naval—but not aerial—attack by the famous fortified islands, 33 miles away at the entrance to the bay. One of these, Corregidor, was immortalized by the siege of 1942. Parts of Manila were of masonry, and one section, the Walled City, was built of seventeenth century masonry. The Japanese garrison behaved with great courage, though with extraordinary barbarity, and the port was finally reduced only after a tremendous attack, supported by heavy artillery.

When the United States finally captured the wharves it was found that not only had they been attacked by heavy artillery and bombers, but also they had been scientifically sabotaged. Sections spaced from 160 to 400 ft apart, and themselves 65 to 80 ft long, were blown up. Not only was the decking destroyed, but the heads of piers were demolished and sheds were blown up. Every undestroyed ship in the harbor was sunk in the most vexing place possible. When the port was taken, it was an engineer's nightmare.

The immediate problem was to convert this nightmare into a port capable of carrying the commerce of over

a million soldiers, stationed in a country which had been so wrecked by raiders and guerillas that it could not support its own population, still less its alien rescuers. To some extent supply could be accomplished by direct movement from America to principal ports developed by the Army. One of these, Tacloban in Leyte, had actually been made into a satisfactory ocean port, with docks, cargo-handling devices and warehouses, before Manila was captured. But the normal pattern of trade was inescapable. The big labor supply was around Manila. Only around Manila could integrated supply facilities be formed. And Luzon, on which Manila is situated, is the largest island and the one where the most Japanese troops were still functioning. Manila had to be restored—and in a hurry!

The first step was to provide access from deep water to shore. All the wrecks were charted, and the Navy started removing them in order of harmfulness. Simultaneously the Army Engineers began repairing the necessary docks. Timber piles, usually creosoted, were driven to replace damaged concrete ones. Timber decking was laid to replace the bombed and broken permanent decking. Several complete new timber piers and two floating piers were constructed. Two hopper dredges were secured from the United States. These craft not only performed all the maintenance dredging which had accumulated over the years of the Japanese occupation, but deepened the harbor considerably. Before Corregidor was retaken, the terminals at Manila were able to handle freight.

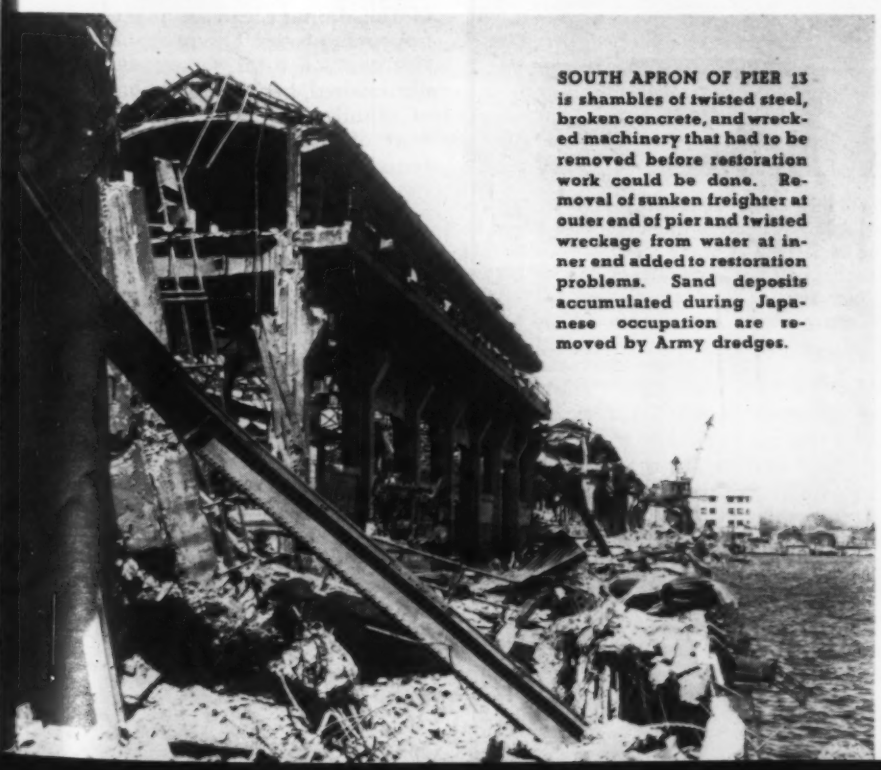


SKILLFULLY SABOTAGED SECTION of Pier 13 floor is repaired. Ship in background unloads on restored apron. Bailey bridge (right background) is used to span demolished floor section of apron.

By V-J day it was warehouses and not docks that formed the bottleneck.

Similar performances with similar results occurred at all these insular ports which were required for the use of American fighting men. So widely distributed was the fighting in the spring and early summer of 1945 that some work was done by the Army at practically every important port. Except at a few localities where ground forces did not appear but air forces previously had, the efficiency of Philippine ports at the end of September 1945 was greater than it had ever been before.

But the vast majority of these new structures had one fatal defect. They were made of timber, some creosoted and some untreated. In all Philippine waters anything made of timber, no matter how carefully treated, is subject to the action of marine borers. These are creatures of almost incredible energy and voracity. In the Philippine air, flat wooden structures, like decking for wharves, rot with great rapidity and are also subject to insect attack. About the only way to preserve anything made of wood in the Phillippines is to immerse it in clear fresh water—hardly a practicable solution.



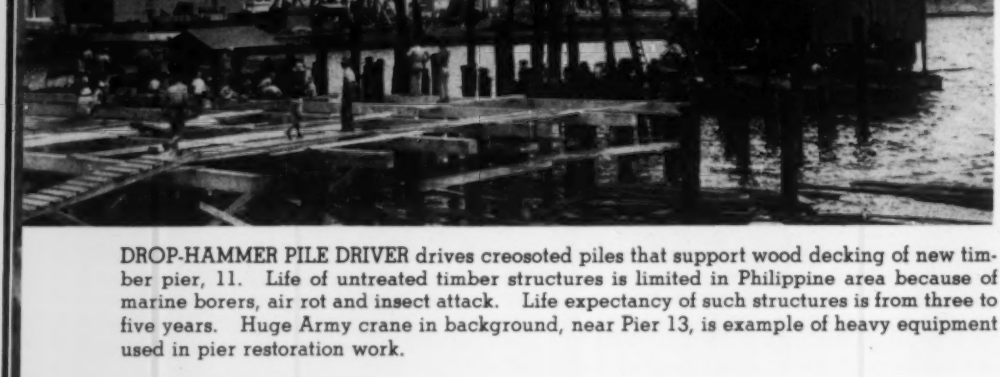
SOUTH APRON OF PIER 13 is shambles of twisted steel, broken concrete, and wrecked machinery that had to be removed before restoration work could be done. Removal of sunken freighter at outer end of pier and twisted wreckage from water at inner end added to restoration problems. Sand deposits accumulated during Japanese occupation are removed by Army dredges.

Destruction of Records Handicaps Work

There were five major factors to be taken into account in preparing a remedy for the ravages of war: (1) What did the people have before the war and was it adequate? (2) What was the nature of the damage? (3) What kind of repairs had been made? (4) What did the Filipino people now want? (5) What demand on insular ports would be caused by the operation of postwar American bases?

In the average settled community, where land routes for mail and wire routes for telegrams are open, and where clerical and subprofessional services are readily available and records are intact, it is comparatively easy to determine these factors. But in the Philippines of the fall of 1945, none of these conveniences were available. The basic records had been destroyed in many cases, and quite a little detective work was often required to determine what existed before the war. The ultimate plans of the Philippine Bureau of Public Works were available, but it was hard to find out, in all cases, whether any

DROP-HAMMER PILE DRIVER drives creosoted piles that support wood decking of new timber pier, 11. Life of untreated timber structures is limited in Philippine area because of marine borers, air rot and insect attack. Life expectancy of such structures is from three to five years. Huge Army crane in background, near Pier 13, is example of heavy equipment used in pier restoration work.



BUILDINGS NOT TOO BADLY WRECKED are roofed to protect materials subject to damage by tropical storms. Other items are stored in the open. Elaborate traffic patterns for truck haulage are arranged to keep ship cargoes flowing smoothly to storage areas. In addition to prewar piers, two timber trestle piers and two floating docks provide total of 20 Liberty-ship berths at all fixed piers and four at floating piers. Petroleum, oil and lubricant unloading pier added to port facilities can handle 3,000 bbl per hour. Shown here are Piers 9 and 13.

such development was needed for the immediate future.

The amount of damage at the ports was roughly known from intelligence records, but here again it must be remembered that fighting units are not much interested in ports that they hold for a day or so of hard combat, and then victoriously abandon for a newly taken one. The repairs made at the ports needed for exploitation were pretty well known, as the engineers well in the rear of the front had to make up projects to get materials and special equipment, but it was sometimes hard to find out what kind of timber had been used. Some minor ports had been repaired, however, by combat engineers using local materials and troop equipment but few records were left behind. The Commonwealth officials knew about what they wanted at the major ports, but in the case of many minor ports they had so much difficulty in communicating with the local authorities either by mail or radio that no data were available. Finally, the Army and Navy plans depended on the size of the forces to be used as postwar garrisons, and nobody knew these. A basis for all-out first-rate planning was just not there.

Manila Records Found

There was one fortunate circumstance. Records at Manila—a port twice as important as all other Philippine ports combined—were found, although not with ease. The place had been well photographed, ground inspection was easy, and repairs had generally been carefully recorded. So the study of this important port on the ground was entirely practicable.

But there are 64 official ports in the archipelago, most of which have no land communication by first-class roads in the American sense. Therefore a general survey on the ground was impracticable within the time limit, except at Manila and a few other places near operating Army airfields.

The plan adopted was to examine the ports from the air and to check the results of this visual inspection against the available military and insular reports. From a low-flying airplane, the character of war damage can be estimated pretty well, unless the damage has been repaired. Any kind of repair acts as camouflage. By this sort of checking, the nature of the damage can be pretty closely approximated. The probable error of the cost of total repair was greatly diminished, because the rehabilitation of Manila will cost as much as 85 percent of that of all other ports combined. The port of Manila, as was previously stated, could be surveyed by conventional methods. Cebu, the second port of the islands, could also be examined on the ground.

Material and Labor Costs High

The greatest potential source of inaccuracy in the resulting estimates is in the figures used for unit costs. In the fall of 1945 labor costs were way out of sight. This was partly the result of direct inflation, caused by the letting loose of much Army pay on a semistarved invaded people. Partly it was because ordinary sums of money were more or less valueless. Non-essentials could not be imported,

and any goods brought from hiding commanded fantastic prices. Finally the military authorities provided some food for their workmen, and thus could pay lower wages; while competing employers had to pay more. Prospective labor costs after the American soliders go home is thus a clear guess.

On the other hand the general experience before the war was that construction costs in the islands tended to be the same as home costs. Labor cost much less per man-hour, but more man-hours were needed. What was gained in labor was lost in ocean freight on imported materials and equipment, and in increased overhead due to difficulties in communication. The rule was approximate but it was fairly good.

In 1945 the rough rule-of-thumb for postwar construction costs used by most engineer officers was 1940 prices plus 25 percent. While this rule gave figures too low for 1946 construction at home, as was found out later, the mistake was at least uniform. Errors are absolute and not relative, and do not greatly affect engineering plans. The writer's estimates were based on the general principles used at home. To cover the insular costs increased by war and devastation, an additional 10 percent was added to the 25 percent surcharge.

The theory behind this low loading, which is less than military men conversant with the islands would have allowed, is that costs in a tropical state cannot get too far ahead of metropolitan costs inside the same customs frontier, without stopping production for export altogether. Such, at any rate, has been the economic experience in the past. When production falls, the pressure of displaced men for food causes the wages of the comparatively few laborers not laid off to fall and brings wages down to a normal level.

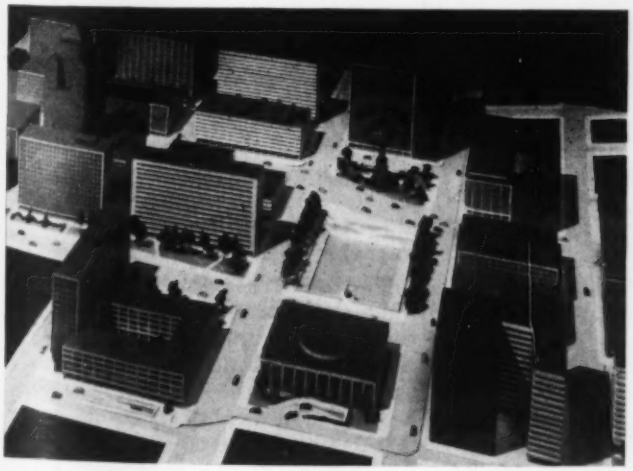
The required report reached Washington 54 days after the writer left the United States for the Philippine Islands. It would have been hard to write very good estimates for $15,000,000 worth of scattered improvements in a normal country in that length of time, and it was certainly impossible to do a perfect job in the war-worn and shattered archipelago. But perhaps this paper can qualify as a pioneer tale of engineering from the air. The circumstances which justified it are not likely to be repeated.

Based on a paper presented by Colonel Hall before the District of Columbia Section on May 20, 1947.

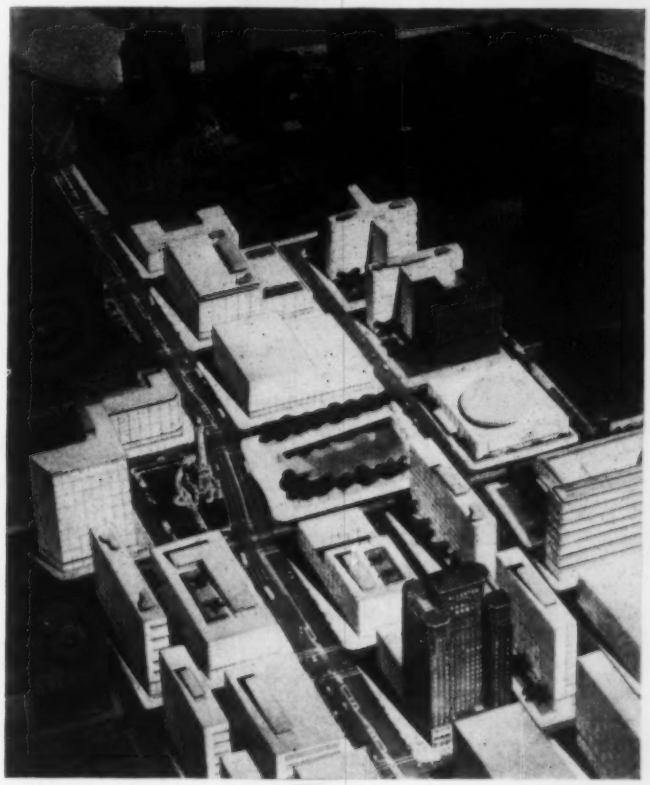
Chicago "Magnificent Mile" Plan Provides Large Underground Parking Facilities

WITH PARTICULAR EMPHASIS on adequate parking facilities, Chicago's $200,000,000 building program for upper Michigan Avenue is designed to make the 11-block stretch from the Chicago River to North Oak Street "the most modern mile in the world." Sponsors of the comprehensive plan, which already has considerable financial backing, are Arthur Rubloff, Chicago real estate manager and broker, and Webb & Knapp, Inc., of New York, who assembled the East River site in New York City to be occupied by the United Nations headquarters. The firm of Holabird & Root, architects, are consultants in the development of plans for the area.

WATER TOWER SQUARE, at intersection of Michigan and Chicago Avenues, as envisaged in Rubloff plan, removes obsolete pumping and fire stations. Two-level underground parking area beneath hall of music (center foreground), pool, and monument in background has 1,500-car capacity. Plan also suggests construction of two-level parking area under Lake Shore playground with 3,000-car capacity. ↓



MAGNIFICENT MILE includes stores, offices, hotels and apartment buildings. Buildings fronting on Michigan Avenue are of moderate height backed by taller buildings on flanking streets, with 60-ft-wide walks between, thus avoiding canyon-like appearance of main thoroughfares. →



Engineers' Notebook

Nomograph Aids Use of Boussinesq Equation

IRA J. HOOKS, New York, N.Y., and HAMILTON GRAY, Assoc. M. ASCE,
Professor, Department of Civil Engineering, University of Maine, Orono, Me.

TO REDUCE THE TIME required for computing stresses beneath loaded foundation areas, Dr. Glennon Gilboy, Assoc. M. ASCE, published, a number of years ago, an "Influence Table for the Solution of Boussinesq Equation" (PROCEEDINGS, ASCE, Vol. 59, p. 781). This equation gives the normal stress acting on horizontal planes beneath the surface of a semi-infinite homogeneous elastically isotropic solid supporting a concentrated load on its horizontal surface.

This expression for stress can be extended by integration to cover uniform or variable loads distributed over finite or infinite areas of different shapes. When the loaded areas are complex in plan, or the load intensity varies irregularly, or when the influence of remote isolated footings is sought, the use of the basic point-load formula is often the simplest procedure. Consequently, the publication of the aforementioned influence table materially reduces the time required in making such computations.

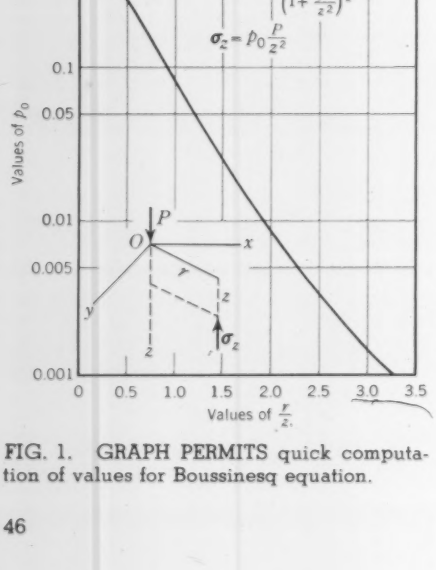


FIG. 1. GRAPH PERMITS quick computation of values for Boussinesq equation.

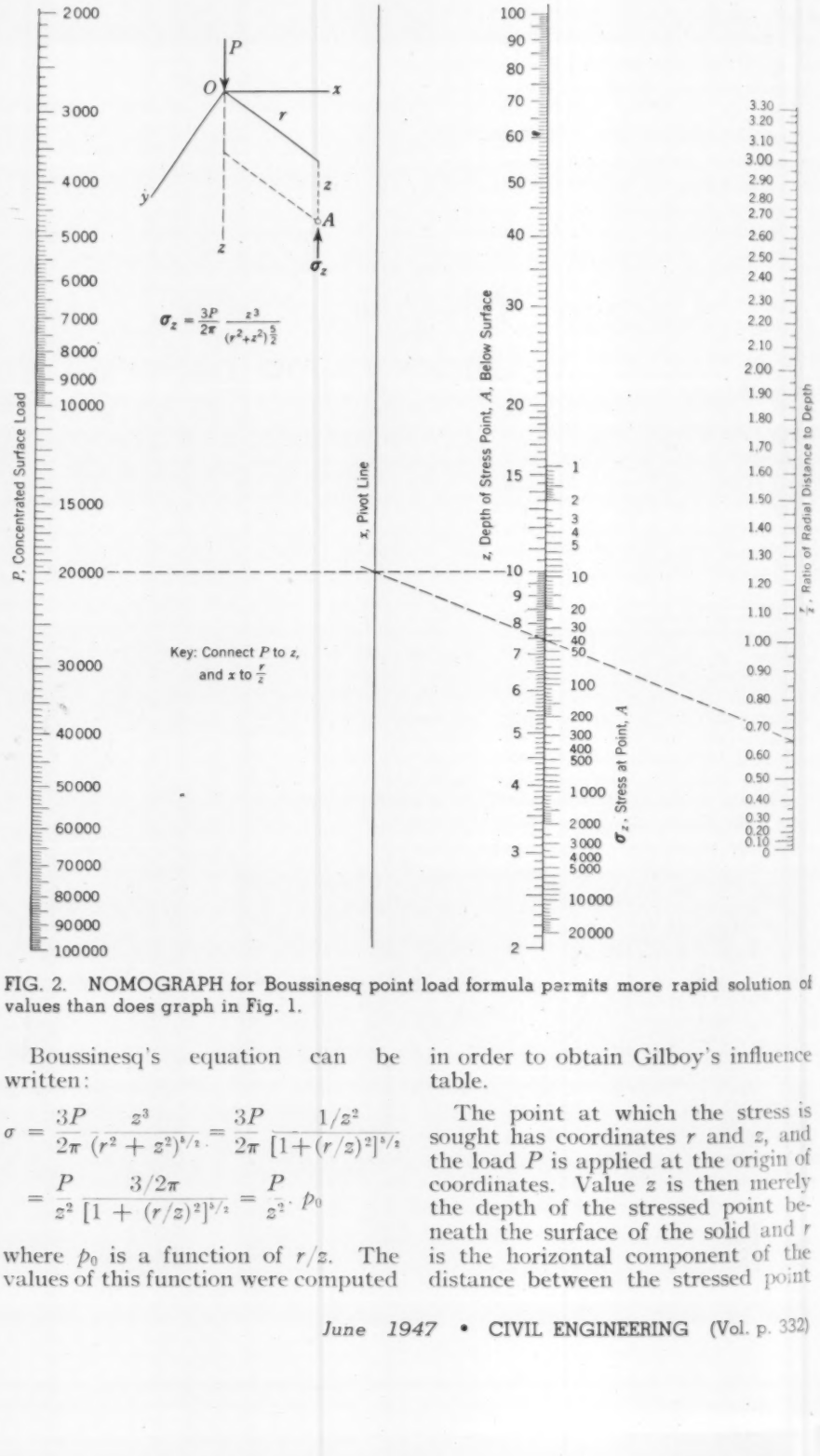


FIG. 2. NOMOGRAPH for Boussinesq point load formula permits more rapid solution of values than does graph in Fig. 1.

Boussinesq's equation can be written:

$$\sigma = \frac{3P}{2\pi} \frac{z^3}{(r^2+z^2)^{5/2}} = \frac{3P}{2\pi} \frac{1/z^2}{[1+(r/z)^2]^{5/2}}$$

$$= \frac{P}{z^2} \frac{3/2\pi}{[1+(r/z)^2]^{5/2}} = \frac{P}{z^2} \cdot p_0$$

where p_0 is a function of r/z. The values of this function were computed in order to obtain Gilboy's influence table.

The point at which the stress is sought has coordinates r and z, and the load P is applied at the origin of coordinates. Value z is then merely the depth of the stressed point beneath the surface of the solid and r is the horizontal component of the distance between the stressed point

and the point of application of the load.

For practical purposes, a chart such as shown in Fig. 1 permits greater speed and affords all necessary accuracy in making such computations. An even more rapid solution is obtained by means of the nomograph shown in Fig. 2. Actual time trials have invariably indicated that solutions could be obtained more rapidly by means of the nomograph than by either the influence table or the influence graph. For some people the difference in time was very marked, and it was also observed that errors were committed far less frequently when using the nomograph than when employing either the influence table or the graph. In view of this saving of time, it is thought feasible to offer these computational aids to the practicing engineer. The technique of using the nomograph is explained by the "key" thereon, and the use of the influence graph is self-evident from an inspection of the equation given herein.

It would appear wise to warn users of the unknown factors involved in applying Boussinesq's formula and its extensions, such as the discrepancies that exist between the behavior of actual soils and the assumed elastic medium of the Boussinesq theory.

Graphical Method Locates Point of Breaking Ground at Crest of Unstable Slopes

R. G. HENNES, M. ASCE

Associate Professor of Civil Engineering, University of Washington, Seattle, Wash.

IN THE ANALYSIS of stability of earth embankments and cuts, the commonly used procedure involves application of the conditions of static equilibrium to the mass of earth lying above an assumed curvilinear slip-surface. It is generally assumed that the trace of the slip-surface on a transverse plane is a circular arc. The lack of any permanent tensile strength in earth causes an error in this conventional analysis when applied near the crest of the slope; because as the limits of stability are approached, a vertical tension crack must occur, replacing the upper part of the usual cylindrical surface as the boundary of the unstable earth mass. This break is shown as the line GE in Fig. 1. The conventional slip-surface $IDEF$ is more correctly replaced by the surface $IDEG$ in applying the conditions of static equilibrium. The location of GE can best be accomplished by the following graphical procedure.

Locate O, the critical center of rotation as determined by the usual method of trial analyses. Draw the radius OM, where M, is chosen at random on the upper end of the slip-surface. Draw the vertical MN. Draw NJ perpendicular to OM. Then MN is proportional to the weight of material above M, and JM is proportional to the normal component of earth pressure on the slip surface. Draw KM at an angle ϕ' with OM. If U is the factor of safety as previously determined for rotation about O, then $\phi' = \phi/U$. The unit frictional force at M corresponds to JK, and the resultant earth pressure at M is reproduced to scale by MK. The horizontal component of the resultant earth pressure is given by KK'. The magnitude of this line, m, is reproduced in the diagram below the sketch, where it is laid off as a vertical distance from the baseline from a point directly below M.

The curved line of the diagram is obtained by repeating this process for a reasonable number of points along the arc MF. The area below the curve thus obtained, multiplied by the square of the linear scale and by the unit weight of earth, is equal to the horizontal component of the resultant earth pressure along arc MF.

It is apparent that the horizontal component of the effective cohesion along the arc MF equals the product of the unit cohesion, $c' = c/U$, and the horizontal projection of the arc MF. Where these two opposing horizontal forces are equal, the resultant horizontal force on the vertical interface, GE, is zero, whereas on any parallel face to the right of GE there is tension, and to the left, compression.

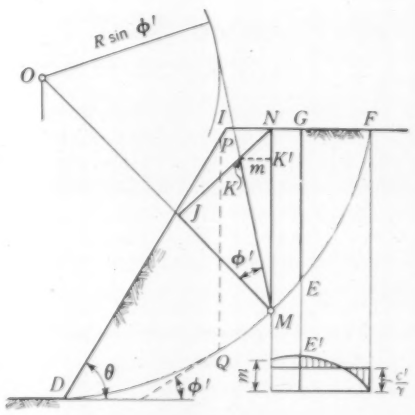


FIG. 1. GRAPHIC METHOD for computing vertical tension crack, GE, eliminates error introduced by conventional analysis that assumes trace of slip-surface describes circular arc DF.

In the lower diagram this condition of equilibrium is satisfied when the area below the M-curve equals the area below the horizontal line whose ordinate is c'/γ, gamma being the unit weight of the soil. It is sufficiently accurate to balance the shaded areas by eye. The point E', where balance is achieved, locates the boundary of the tensile zone, GE.

Having obtained the corrected slip-surface, DEG, the corrected factor of safety for this modified section should be computed in the usual manner. The correction is of appreciable but not great magnitude.

The physical significance of this lies in the excess resistance accumulated by cohesion along the steep portion of the curve in the section GFE. This resistance could only be made effective for the integral mass $IDEF$ if the soil possessed tensile strength. In contrast, the excess resistance due to friction along the surface DQ requires only compressive strength to resist the thrust of the unstable earth mass, $PQEGI$.

In addition to permitting a more precise determination of the factor of safety of the slope, location of the line GE serves to indicate the boundary of relatively stable ground. This should be useful in locating conduits where there will be less danger that shear-strains may cause joints to open. Leakage from displaced sewer and water lines has frequently induced major slides.

... THE READERS Write

Work Accredited to Corps of Engineers Questioned

To the Editor: Having held a commission in the Corps of Engineers Reserve for the past 30 years—including more than two years of active oversea's service in one war and three years of civilian engineer service with the office of the Chief of Engineers in another—I can hardly be suspected of being lacking in appreciation of the accomplishments of our Army Engineers.

It is, however, hard to believe that without the Corps of Engineers our Western railroads would have been delayed for half a century, as stated in the article on the Corps of Engineers in the April issue of Civil Engineering. For a specific instance, I do not recall that John F. Stevens, Past-President and Hon. M. ASCE, was connected with the Army when he located the Great Northern route. The Erie Canal was a project put through by the State of New York.

As to the Panama Canal, the article in Civil Engineering gives the impression that in 1907 the Army Engineers took over the job after "the French... had to admit failure" and, under Col. George W. Goethals, M. ASCE, surmounted every conceivable obstacle from impenetrable jungle to dirt avalanches, and completed the task. Colonel Goethals was a great engineer and a good friend of mine, but he took over, not from "the French," but after three years of American work—the first under John F. Wallace, Past-President ASCE, and the latter two under John F. Stevens, who had cleared out all the "impenetrable jungle," decided the type of canal to be built, and turned over to his successor a working plant and organization.

During Stevens' tenure, adequate quarters were provided for the working organization. Water works, sewers, and paved roads made possible mosquito control and the elimination of epidemic disease by Colonel Gorgas, of the Army Medical Corps.

It is a popular misconception that the Army built the Canal. Colonel Goethals and many of his subordinates were Army Engineers. However, they were not under the orders of the Chief of Engineers or in his organization, but serving as individual members and employees of the Isthmian Canal Commission under the Secretary of War.

Many of the Canal staff—except at the top, under Colonel Goethals as chairman and chief engineer of the Commission—were civilians. Of the three division heads, two were Army engineers. But Sydney B. Williamson, M. ASCE, who was in charge of the Pacific Division, was an eminent civil engineer. The successful excavation of the Culebra Cut, for several years under both Stevens and Goethals, was handled by Louis K. Rourke, M. ASCE, as assistant division engineer. Rear-Admiral H. H. Rousseau, M. ASCE, member of the Isthmian Canal Commission, was put in charge of municipal engineering, motive power and machinery, and building construction by Colonel Goethals and later was assistant to the Chief Engineer.

At no time was the Isthmian Canal Commission under the Army. As an independent organization it reported directly to the Secretary of War. All these matters of responsibility and organization are of record in the annual reports of the Canal Commission and in the two volumes on the building of the Panama Canal published in the Proceedings of the International Engineering Congress at San Francisco in 1915.

Henry Welles Durham, M. ASCE
Sandwich, Mass.

[Information referred to in the above discussion is from the War Department Bureau of Public Relations Division bulletin, entitled "Army Week." Editor.]

ASCE Member Approves Proposed Dues Increase

Dear Sir: The *Engineering News-Record* editorial, "Something for Nothing," which you quote in the "Society News" item, "All Four ASCE Zones Sign Petitions," in the May issue, is thought provoking. It states, among other things, that "An issue of interest to all professional societies is raised by the cool reception accorded to the current plan to raise the dues of members. . . ."

Any engineer who is unwilling to have his dues raised $5 a year for the betterment of his organization certainly must be dubious about its benefits to him. Or if $5 is of such moment to him, his economic status is not what it should be.

It is difficult to measure the benefits of membership in organizations like the ASCE. These benefits are there, nevertheless, and thoughtful members know it. Thoughtful members know, too, that those who do most for the Society benefit most from it. So many do nothing for their organizations and then complain about receiving no benefits from them. There are too many of the type mentioned in the editorial—those seeking "something for nothing." Things just don't work out that way. Many never learn that age-old fact.

Harry O. Locher, M. ASCE
New York, N.Y.

Calls Proposed ASCE Dues Increase Justified

To the Editor: The article on page 50 of the May issue of Civil Engineering that quotes the *Engineering News-Record* editorial on the proposed raise in ASCE dues and the supposed opposition to this move by our Members struck me as being a very fair résumé of the subject.

I believe that the dues should be raised. The splendid work the Society is doing—the enlarged scope of its activities—has certainly increased the cost of operation. I do not think that an additional $5 per annum for these great services can be a hardship to any Member.

Joseph A. Jordan, M. ASCE
Washington, D.C.

Economy Determined Use of H-Pile Foundation

Dear Sir: The writer has read with much interest the article, "Welded Steel Piles Support 26-Story Skyscraper in Back Bay Area of Boston," in the March issue. I am familiar with the project and would say that the article is well written and accurately sets forth the facts, with one exception.

On the first page, fifth paragraph, it is stated that, "Foundations to rock, such as compressed-air caissons, drilled-in caissons, 24-in. driven steel shells, and steel H-piles were also reviewed. The first three types were abandoned to eliminate the risk of disturbing the underlying soft blue clay to a point where settlement of surrounding structures might ensue." This statement is in

error, since the sole reason for the use of the H-piles over drilled-in caissons and 24-in. driven steel shells was economy.

The conditions at the site were ideal for H-beams and their use provided an adequate foundation at a minimum cost.

CHARLES B. SPENCER, M. ASCE
Vice-President, Spencer, White & Prentis, Inc.
New York, N.Y.

Early Use of Construction Equipment Recalled

DEAR SIR: Just to keep the record straight, I would like to point out that the "slip" shown on page 74 of the February CIVIL ENGINEERING is, in reality, a "Fresno" scraper.

I do not know when these Fresno scrapers were first introduced, but I do know that several contractors were using them in 1907 when I arrived on the Yellowstone Project of the U.S. Reclamation Service in northeast Montana. Most team contractors were using two-horse slip scrapers. Within a few years the Fresnos had almost completely replaced the slips. As I recall, a contractor on the Yellowstone Project informed me that a 4-horse Fresno could average about 85 cu yd per 8-hour day. Quite a contrast to the output of a modern scraper like the GarWood 515.

Incidentally, the photograph shown was taken on the Fort Peck Project in Montana, about 1910, on work supervised by R. M. Conner, M. ASCE, of Los Angeles, Calif. The driver and the Fresno operator are both Indians.

S. A. KERR, M. ASCE
Sacramento, Calif.

Contract Provisions Cited by Lawyer

DEAR SIR: I would like to comment on Mr. Herwitz's article, "Parties to a Construction Contract Make Their Own Law," in the April issue. In discussing contract provisions exempting the owner for liability for damages caused by delays, Mr. Herwitz states that "despite these clauses, owners have sometimes been held liable for the extra cost to contractors . . ." resulting from such delays.

The United States Supreme Court—in Wells Brothers Co. vs. United States, 254 U.S. 83, and Wood vs. United States, 258 U.S. 120—has held that a contract provision to the effect that no claim will be made or allowed for damages, which may arise out of any delay caused by the government, is enforceable.

In Ericksen vs. Edmonds School District, No. 15, 125P.(2d) 275, the court stated: "It is undoubtedly the rule in this state (Washington) as well as in other states generally, that in the absence of any provision in the contract to the contrary, a building or construction contractor who has been delayed in the performance of his contract may recover from the owner of the building damages for such delay if caused by the default of the owner. . . . Where, however, the contract expressly precludes the recovery of damages by the contractor for delay caused by the owner that provision will be given full effect."

The contract provision in that case was stated as follows:

"Claims for Damages and Extensions of Time. The contractor shall not be entitled to any claim for damages on account of hindrances or delays from any cause whatsoever, but if occasioned by an act of God, or by any act or omission on the part of the owner, such act, hindrance, or delay may entitle the contractor to an extension of time in which to complete the work which shall be determined by the architect, provided that the contractor will give notice in writing of the cause of such act, hindrance, or delay within ten days after its occurrence."

The Court held that the express terms of the contract precluded the contractor's maintaining an action for damages resulting from hindrances and delays.

In Cauldwell-Wingate Co. vs. State, 276 N.Y. 365, the contract contained the following provisions:

"Extensions of time: If the contractor be delayed in the completion of the work by an act or neglect of the State, or by any changes ordered in the work, or by any cause which the architect shall deem to justify the delay as being beyond the contractor's control, then the time of completion shall be extended to such reasonable time as the architect may decide." (Article 33)

"Damages for delays: No changes or claim for damages shall be made by the contractor, under the provisions of this Article, for any delays or hindrances, from any cause whatsoever, during the progress of any portion of the work embraced in this contract. Such delays or hindrances shall be compensated for under the provisions of Article 33."

The plaintiff had a contract to erect the superstructure of an office building. By reason of misinformation furnished by the state, the foundation contractor was delayed in the performance of the work and the foundation job that was to be completed in three weeks extended for almost a year. The plaintiff was allowed a recovery for the damages resulting from the delay caused by the state, the court holding that the exemption clause in the contract was limited to delays occurring during the progress of the work and had no application to delays that prevented the commencement of the work.

I. VERNON WERBIN, Assoc. M. ASCE
Member of New York Bar
Author of "Legal Phases of Construction Contracts"
New York, N.Y.

Urges That Civil Engineers Demand Adequate Salaries

DEAR SIR: Apropos of the current interest in engineering salaries, I quote a want-ad recently observed:

> "CIVIL ENGINEER, 30–40, with construction experience, to supervise new construction, repairs, and maintenance of service stations and bulk plants. Prepare bid proposals, attend to correspondence, write reports, traveling. Salary $3,600 a year. Headquarters, New York, N.Y."

Here is an illustration of an engineer, with four years of educational training, plus eight to eighteen years of experience (assuming the average graduate to be 22 years old), being sought for a position of obvious responsibility, and being offered $69.23 per week, or $1.73 per hour. This, of course, is considerably less than carpenters, masons, and other construction workers earn today in the New York area, and for that matter, not appreciably more than that earned by the driver of the cement-mixer.

Several years ago, before entering the Navy, I served as chairman of a Metropolitan Section Junior Branch committee, which investigated the salaries and working conditions of its members by means of a questionnaire. I felt then, as I do now, that if engineers individually would exercise self-restraint and refrain from accepting salaries not commensurate with their professional education and ability, it would shortly end situations—and there are many of them—where engineers are paid less than men they directly or indirectly supervise.

SIDNEY WENIGER, Jun. ASCE
Plant Engineer, Cleaveland Laboratories & Mfg. Co., Inc.
Peapack, N.J.

Exact Solution in Rod Problem Held Simple

DEAR SIR: Mathematically, the article entitled, "Level-Men Cautioned on 'Waving the Rod,'" by Howard S. Rappleye in the April issue, is of interest because (1) the solution derived for the problem shown is an approximate one, and (2) the exact solution is simpler than the approximate one.

The exact solution is as follows: As the level rod rotates about the back corner, points on the front face travel in arcs, reaching their highest point when vertically above the rear corner. Of all arcs crossing the line of sight, the lowest is the one tangent to it, and having a radius R, the vertical height from the surface on which the rod stands to the line of sight.

In the accompanying Fig. 1, it is evident that this arc is the path of the point on the scale, $\sqrt{R^2 - A^2}$, or $R \cos \alpha$, where $\sin \alpha = \frac{A}{R}$. The error, e, is $R - \sqrt{R^2 - A^2}$, or R vers α and, where the difference is perceptible, is greater than the error given by the approximate method. For example, when $R = 0.2$ ft, $\alpha = 48°35'$ (admittedly a large wave angle) and $e = 0.0677$ ft, as compared with the approximate values of $36°52'$ for α and 0.0625 for e.

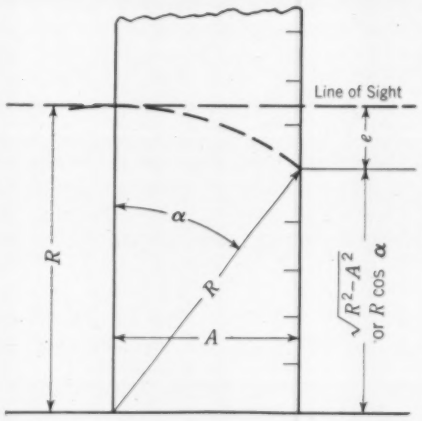


FIG. 1

For quick calculation by successive approximation, $e(2R - e) = A^2$. A first approximation, $e = \frac{A^2}{2R}$, is almost as accurate as the author's approximation, giving $e = 0.056$ for $R = 0.2$.

DAVID B. HALL, Assoc. M. ASCE
Baltimore, Md.

Recommends Circular Rod Level and Angle Target

TO THE EDITOR: My first impression on reading the article, "Level-Men Cautioned on 'Waving the Rod,'" by Howard S. Rappleye, in the April issue, was that the author had forgotten one of the fundamental rules of good surveying technique. Bench marks, turning points, or reference points should preferably be pins, pegs, spokes, plugs, or similar objects, which are rounded on the top, and the rod should not be placed on a "smooth level surface."

However, even if the proper type of bench mark is selected and the rod is waved, an error will be introduced similar to that described by Mr. Rappleye. The pivot point will be at the center of the rod base instead of at the back edge of the foot of the rod and will cause an error of about one-half that shown in Mr. Rappleye's Table I.

For level surveys requiring accuracy within these errors, the fastest and most accurate method is to use a combination of a circular rod level and an angle target. The rod is plumbed with the rod level. Then any slight discrepancies, found by sighting on the angle target, are corrected by signals from the instrumentman.

EDWARD WESP, JR., Jun. ASCE
Mount Vernon, N.Y.

Compound Parabola Used as Vertical Curve

DEAR SIR: The various methods of computing vertical curves as presented in CIVIL ENGINEERING—by Professor Oakey in the October 1946 issue, by Mr. Pettijohn in the February 1947 issue, and by Professors Barnes and Worley in the April issue—are all noted with interest. The parabolic curve as used in vertical alignment is so elementary in theory and application that extensive discussion of the problem is of interest only as regards specific applications.

Professor Oakey's development of basic equations for parabolic vertical curves is strictly fundamental and seems to the writer to be as simple as it is possible to make the problem. In addition, his expression for the tangent offset, $y = \frac{G_2 - G_1}{2L}(x)^2$, is directly applicable to slide-rule calculations of all the offsets from either tangent with a single setting of the slide. This expression can just as simply be developed by substituting $E = \frac{G_2 - G_1}{8L}$ in the expression

$$y = E\frac{(x)^2}{(L/2)^2}.$$

Obviously the tabular form of calculations presented by Mr. Pettijohn is definitely suitable and has been taught and used for perhaps half a century.

Professor Barnes chooses not to compute E, the offset at the intersection of the tangents, but to calculate the tangent offsets for "even" chords throughout the length of the curve, using in the process the same fundamental principle that tangent offsets to a parabola vary as the square of the distance from the point of tangency. The quite general use of the basic 100-ft station for staking vertical and horizontal alignment, the obvious possibility that it may quite often be undesirable to begin and end curves on even stations or fractions thereof, and the fact that it is often necessary to compute grade elevations at odd "plusses" seem to render inadvisable the spending of any time considering a method based on equal chord length, except for very special applications. Certainly, as Professor Worley illustrates, a true understanding of any problem encountered is far more important than the memorizing of any formula or method.

The writer would like to mention a further specific application of the parabolic vertical curve which is sometimes necessary in order to pass the grade through definite control points—that is the use of the compound parabola. Assume that the preliminary work has been done and it is desired to calculate the tangent offsets to a vertical curve of length $L = T_1 + T_2$, where T_1 and T_2 are the horizontal distances along the tangent grades and T_1 is *not* equal to T_2. It is easily proved that the tangent offset from tangent grade line No. 1 is given by the expression

$$y_1 = \left(\frac{T_2}{T_1}\right)\frac{G_2 - G_1}{2L}(x_1)^2$$

Likewise, $y_2 = \left(\frac{T_1}{T_2}\right)\frac{G_2 - G_1}{2L}(x_2)^2$

The *two* parabolas will be tangent at a point which is the bisector of the vertical line joining the P.I. with the straight line drawn from P.C. to P.T., and the grade at this point will be the same as the grade of the line joining P.C. and P.T. Obviously when $T_1 = T_2$, these equations reduce to the fundamental equation presented by Professor Oakey.

This additional "trick" in the calculation of parabolic vertical curves is given with apologies by the writer, as it is realized that interest in special discussion of any problem involving parabolic vertical curves is either academic or personal.

J. C. BRIDGER, Assoc. M. ASCE
Assoc. Prof. of Civil Eng.
Univ. of Tennessee
Knoxville, Tenn.

SOCIETY NEWS

EDITORIAL:

At the Crossroads

AS A PAST-PRESIDENT OF ASCE, I was naturally and deeply interested in the editorial, "Something for Nothing," published in the April 3 issue of "Engineering News-Record" (reprinted in CIVIL ENGINEERING for May, page 50). My interest was increased because my tenure of the Society's highest office occurred during the period in which the policy of pursuing professional, as well as technical, phases of the civil engineering profession, was getting well under way.

It is gratifying to find that while this McGraw-Hill publication speaks of "the cool reception accorded to the current plan to raise the dues of members of the American Society of Civil Engineers," it also states:

"The reason for this is not obvious in the ASCE record. No one could have attended meetings of that society in recent years without gaining a clear impression that, in addition to the society's activities in technical matters, the membership at large wanted it to take the leadership in obtaining wider understanding of the part that engineers play in the daily life of every citizen and in fostering greater dependence on engineers for advice on national and international issues.

". . . There can be no doubt that it was to attain these objectives that successive boards of direction of the ASCE have expanded the society's activities beyond purely scientific fields."

In my opinion, that last sentence, attributing ASCE's relatively recent policy of fostering professional activities to "successive boards of direction," makes an extremely important point. For it emphasizes the fact that the Society's present financial needs do not stem from a single action, but have arisen from a succession of progressive steps taken by the officers and directors who sought to execute the desires of the membership. That inflation and the 26-year interval since dues last were raised are important factors in the Society's economic picture, are so obvious, it seems to me, as to require no argument.

In January of 1946, just before the expiration of my term as President, I called an exploratory conference to consider the Society's future. At that time I said in effect that there are two concepts of the reasons for the existence of the American Society of Civil Engineers: One is to honor the top men of the profession, recognizing their attainments by admission to its membership. As long as membership is based entirely on attainments, the Society will become static and its size will remain relatively small. In the other concept, the accent is on finding means of rendering more service to the whole profession. The Society has hardly scratched the surface of discovering and following through on services that could be rendered either in the technical and research fields, or the professional, economic and social-welfare fields. We are now at the crossroads, for our choice lies between an outstanding static honor society, or an outstanding and growing service Society that will bring honor to us as leaders in our profession.

It is my fondest hope, and my firm belief, that when our membership studies all the facts, as it now is doing, the ballots will result in a decision calling for a continuation of our progress along the path of true professionalism.

J. C. Stevens

Past-President, ASCE

Broader Licensing Act Is Sought in California

FOR THE FIRST TIME in 18 years, a comprehensive bill for the licensing of all professional engineers in California has been introduced in the state legislature. Los Angeles professional engineers are united as never before in their desire to obtain such legislation, and through the Los Angeles Engineering Council of Founder Societies, a special committee for enactment is hard at work.

Although civil engineers in California have been licensed since 1929, they are vitally interested in the current licensing bill. They feel that a professional engineers act for the various engineering groups will be a step forward in California's civil engineering licensing and they therefore have joined with the other Founder Societies in pushing this legislation. At present their representatives on the legislative committees are working on particular details of the act to assure proper protection to civil engineers.

The special committee of the Founder Societies for enactment comprises: J. Calvin Brown, ASME; Dr. Royal W. Sorensen, AIEE; Dr. L. M. K. Boelter, AIChE; Dr. E. O. Slater, AIME; and Donald M. Baker, ASCE, who took an active part in the work for the present Civil Engineers Act.

Collective Bargaining Manual Is Available

CAREFULLY COMPILED information on the National Labor Relations Act (Wagner Act) is contained in Part I of the "Manual on Collective Bargaining for Professional Engineers," just published by the Engineers Joint Council's Committee on the Economic Status of the Engineer. The primary purpose of the manual is to give professional employees a background which would enable them to interpret and appraise current developments in the field of labor relations.

The current publication (Part I) is a well printed 8×11 booklet of 64 pages. ASCE has obtained its share of the limited number of these booklets published, and copies now are for sale to members and others interested. The price is $1.00 per copy.

Orders will be filled as long as the supply lasts. They should be sent promptly to the Executive Secretary, ASCE, 33 West 39th Street, New York, 18, N.Y.

Local Sections Conference Calls ASCE Operations Cost "An Emergency"

INCREASED LOCAL SECTION INTEREST in the forthcoming Constitutional Amendment ballot on the question of increasing ASCE dues was manifested at the Phoenix Spring Meeting Local Section Conference, which adopted a resolution calling the increased cost of Society operations "an emergency" which "will cause curtailment, or possibly abandonment, of necessary professional and welfare activities."

The Conference petitioned the Board of Direction for action "to further publicize this condition to the membership" because, the resolution stated, the Conference believes "the membership is not fully cognizant of this emergency." The resolution suggested that each Local Section, "at a special meeting, or at a regular meeting," thoroughly discuss the financial condition of the Society "with a member of the Board of Direction or a staff member as discussion leader." The resolution suggested further that mailing pieces and other informative material be furnished to the membership.

Covering both the proposed amendment to increase dues and the one to enfranchise Juniors, President E. M. Hastings on May 22 sent the following letter to the presidents of all Local Sections:

"As a leader in your Local Section of ASCE, your assistance is sorely needed in a Society matter of primary importance. That is why I am writing to you on this personal basis—to enlist your aid in impressing upon the Corporate Members in your Local Section the necessity of taking a position on the Constitutional Amendments which would (1) enfranchise Juniors and (2) increase Society dues.

"Your national officers and Directors share with me the deep-rooted belief that the best interests of our Society and our profession will be served only if a very substantial portion of our entire Corporate Membership votes on these issues. Naturally, it is desired that the Corporate Membership shall be in full possession of all pertinent facts prior to the time of balloting.

"Briefly stated, the question each of us must ask himself is:

"Shall the Society continue its present broad program of professional activities and expand that program, as it has in the recent past, or curtail those activities and effectuate a return to something more closely resembling the purely technical organization it was during its first 70-odd years?

"Since they are the only ones empowered to vote on the interrelated Constitutional Amendments for enfranchising Juniors and increasing the Society's inflation-affected income, our Corporate Members hold the key to the future for our Society and our profession. It is important, therefore, that they exercise that power wisely and in the light of all the information available.

"Although CIVIL ENGINEERING is continuing to bring the facts to our entire membership, Local Sections should discuss these facts frankly and fully at meetings devoted to these all-important Constitutional Amendments.

"Therefore, I urge you, as head of your Local Section, to:

(1) Arrange for an early meeting of your Section at which these issues will be discussed by your Director or headquarters staff member.

(2) Call to the attention of your membership pertinent information in recent, current and forthcoming issues of "Civil Engineering."

(3) In addition to announcements made at meetings of your Section, direct attention of your members to the facts and the need for participation in the balloting by means of information which your Local Section Secretary can include with notices of meetings, thus reaching even those who do not attend Section meetings regularly.

"As a leader in your area, your cooperation in these efforts to continue our Society as a growing, progressive, and truly professional organization, is expected and will be appreciated."

At its meeting in Phoenix, the Board of Direction thoroughly discussed the petitions which have been received from all four ASCE zones in more than sufficient numbers to send the dues increase proposal to ballot as a Constitutional Amendment. Strong presentations were made by Directors representing the Metropolitan Section for elimination of the dues differential which now exists against members of that Section, and there appeared to be unanimous agreement on the part of the Board members that this differential is unwarranted.

However, the Board voted that the language to cover the amendment, which will be circulated to all Corporate Members 25 days prior to the date of the 1947 Summer Convention, will be in accordance with the expressed intent of the language presented in the official petition for change in dues, signed by 1,459 members in the four zones, and that the circularized amendment will be accompanied by a statement that the Board proposes, at the Annual Convention, to present an amendment pertinent to the proposed amendment, to provide that the annual dues for all Juniors shall be $12.50. At present, Metropolitan Section Juniors pay $5 more per year in dues than those in other Sections, as do Corporate Members and Affiliates in that Section.

Action Program Adopted by Fire Prevention Group

AN ACTION PROGRAM urging acceptance on the part of public officials of greater responsibility for fire safety, and wider public support for all measures dealing with fire prevention was adopted by The President's Conference on Fire Prevention at its recent meeting in Washington, D.C. ASCE was represented at this conference by James E. Jagger, Assistant Secretary.

The action program adopted urged that Maj. Gen. Philip B. Fleming, M. ASCE, Administrator of the Federal Works Agency and general chairman of the Conference, appoint a continuing committee to implement the Conference recommendations and to provide a gage on progress made throughout the nation.

Committees recommending action to the Conference were: Law Enforcement, Building Construction, Fire-Fighting Services, Fire Prevention Education and Research. In building construction the action program recommended that construction materials be selected for their fire-resistant properties, that adequate barriers be provided to prevent spread of fire, that proper extinguishing equipment be installed.

Student Chapter Members Total New High of 6,500

TOPPING BY OVER 2,000 last year's enrolment, the greatest Student Chapter enrolment in the history of the Society brings the total to more than 6,500. This membership is distributed in 125 Chapters and several branches, located in every state in the Union and in Alaska. The University of Illinois has the largest single Chapter, with a membership of over 250.

The total of 125 Chapters includes 25 that were reactivated during the past year to serve the needs of student bodies augmented by returning G.I.'s. Two new Chapters, authorized by the Board of Direction as recently as April, are located at the University of Alaska, College, Alaska, and at Wayne University, in Detroit.

Three of the Chapters—those at the University of Cincinnati, Brooklyn Polytechnic Institute, and New York University—have found it necessary to form two sections to meet the needs of two groups of students attending classes on different schedules.

PHOENIX RADIO STATIONS accord total of hour and quarter to prepared broadcasts on Spring Meeting, activities of civil engineers, and Society affairs. Members of one symposum, photographed as about to go on air, are, left to right: Director John H. Gardiner, Tucson, President E. M. Hastings, Executive Secretary William N. Carey, Past-President W. W. Horner and Vice-President Gail A. Hathaway.

WELCOME TO PHOENIX is extended to President E. M. Hastings, left, by Walter Johannessen, president of Arizona Section and chairman of Committee on Arrangements, while Director John H. Gardiner, Tucson, Ariz., second from left, and Col. William N. Carey, Executive Secretary, look on.

ARIZONA SECTION PRESIDENT, Walter Johannessen, head of Committee on Arrangements, confers with Mrs. Fred Guirey, chairman of committee that did excellent job of entertaining ladies.

PHOTOGRAPHER ATTENDS meeting of ladies' committee, composed of, left to right, seated: Mrs. W. H. Becker, Mrs. John A. Carollo, Mrs. Harold Yost; and standing: Mrs. E. V. Miller, Mrs. Walter H. Coleman, Mrs. John Girand, Mrs. R. L. Derby, Mrs. Ralph Hoffman, Mrs. W. W. Lane, Mrs. Clyde Myers, Mrs. Carl Huskison, Mrs. W. C. Lefebvre and Mrs. August Rath.

WESTERN AND SPANISH COSTUMES worn by Arizona Section members and wives add zest to Western Party staged by Section for visiting engineers.

AT REGISTRATION DESK, Dorothy Kort pins badge on Westerner A. M. Rawn, Los Angeles, Past-Director, in presence of another Past-Director, Easterner Scott B. Lilly, Swarthmore, Pa.

ASCE President Hastings and Secretary Carey Address West Coast Sections

MATTERS OF VITAL concern to the Society and the engineering profession were discussed by President E. M. Hastings and Executive Secretary William N. Carey on a 2,000-mile speaking tour of ASCE Sections and Student Chapters in West Coast cities, following the Society's Spring Meeting at Phoenix, Ariz.

In his talks before the various groups visited, President Hastings emphasized the urgent need for engineers to concern themselves, both locally and nationally, with matters of general public welfare. He pointed out that the Society stands today "at the fork of the road."

"It can continue," he stated, "to make creditable progress along the road of purely technical advancement, or it can take the broader highway of opportunity wide enough to accommodate both technical advancement and the more elusive element of professional advancement." President Hastings urged Members to lend their efforts toward taking the Society along the broader highway.

Executive Secretary Carey, in his talks, discussed professional advancement as related to the budget of the Society. He gave many examples of the Society's professional activities, as differentiated from its purely technical activities, and indicated the benefits accruing to every engineer from the professional efforts exerted by ASCE.

Emphasizing that all these activities necessitate the expenditure of time and money, Secretary Carey reported that the budgeted expenditures, amounting to approximately $700,000 for the fiscal year 1947, are some $56,000 over the expected receipts for that period. He urged careful study of the professional activities of the Society, present and prospective, pointing out that an increase in Society income must be obtained if material reduction in future professional activities is to be avoided.

President Hastings' and Executive Secretary Carey's 12-day tour of the West, on which they were accompanied by their wives, included a luncheon at the Yuma Engineers Club, an inspection trip to Imperial Dam and, under the guidance of Col. H. M. Arnold, Assoc. M. ASCE, an inspection tour of the Yuma Branch of the Army Engineer Board (see accompanying photo). President Hastings and Executive Secretary Carey spoke at a dinner meeting held by ASCE members living in and near El Centro, Calif. Two days of entertainment by the San Diego Section included visits to points of engineering interest in and near the city. A meeting of the Section featured talks by both of the Society officers.

The President and Executive Secretary attended a meeting of the Los Angeles Section at which both officers spoke. Hopping from Los Angeles to Sacramento by plane, the party was entertained by ASCE Director F. W. Panhorst and former Vice-President Thomas E. Stanton, preceding a dinner meeting of the Sacramento Section. In San Francisco both President Hastings and Secretary Carey addressed a dinner meeting of the San Francisco Section in Berkeley.

A motor trip through the California redwood groves brought the party to Corvallis, Ore., where the two national officers addressed a luncheon meeting of civil engineering students at Oregon State College. Proceeding to Portland by car, they spoke at an evening meeting of the Portland Section. The party also attended a dinner meeting and dance sponsored jointly by the Seattle and Tacoma Sections at which both Society officers spoke, as did Director W. L. Malony.

Inspection of the new civil engineering building, a new 2,400,000-lb testing machine, the Tacoma Bridge wind tunnel experiments and a hydraulic model demonstration, all on the campus of the University of Washington, followed speeches before the civil engineering students by President Hastings and Secretary Carey. Before returning with Mrs. Hastings to the East by train, President Hastings spoke at a meeting of the Spokane Section. Director Malony also spoke at this meeting.

Executive Secretary and Mrs. Carey ended their 12-day tour at Seattle on May 8, when they took a plane for the East.

TOUR OF WEST COAST cities by President Hastings, Executive Secretary Carey and wives included inspection trip to Yuma Engineer Board Proving Ground. Party inspecting M4A2 bridge includes, at extreme left, Col. H. M. Arnold and William N. Carey, and President Hastings at right.

Local Section Group Suggestions Approved

AT ITS SPRING MEETING in Phoenix, the Board of Direction of ASCE approved several recommendations made by the Committee on Local Sections following the January 1946 Exploratory Conference, at which the subjects were discussed.

The Board approved a Local Sections Committee recommendation that "It is recognized that it is entirely proper for the Society or its members, or Local Sections, to engage in a dignified and orderly campaign for new members. More emphasis, generally, can be placed on the matter of securing new members without, in any way, lowering the professional standards."

The Board also approved the following recommendation made by the Committee on Local Sections: "That strong and balanced membership committees be established in each Local Section, committees to be charged with the responsibility of inducing engineers to join the Society as Juniors. Local Sections should invite and encourage Student Chapter members to attend all Local Section meetings, to stimulate interest upon graduation, in joining as Juniors."

Other recommendations by the Committee on Local Sections of which the Board approved are: "That each Local Section, with the advice of the Executive Secretary, handle the matter of Local Section employment services as appears best for the particular area"; and "That

the matter of Junior forums should be handled by the individual Local Sections, and if there appears to be a local need for such forums, they should be formed."

Another matter on which the Committee on Local Sections made a recommendation was one involving the question of establishment of technical divisions by Local Sections. On this matter, which also stemmed from the January 1946 Exploratory Conference, the Committee on Local Sections recommended "that this matter be left at the option of Local Sections in direct cooperation with Technical Divisions." The Board approved this recommendation also.

Dam Club of C.C.N.Y. Sponsors Speaking Contest

A PANEL OF ASCE members, headed by Executive Secretary William N. Carey, recently acted as judges in the McLoughlin Student Paper Prize Competition, sponsored by the Dam Club of the College of the City of New York. The other judges were H. Alden Foster, Alfred T. Glasset, Leslie G. Holleran, Harold M. Lewis, Harry O. Locher, Charles B. Molineau, and J. P. H. Perry.

The competition honors the memory of Frederic O. X. McLoughlin, M. ASCE, professor of civil engineering at C.C.N.Y., who died in June 1936. Professor McLoughlin customarily sponsored student paper prize competitions, in which the award was the entrance fee and dues for ASCE Junior membership. The Dam Club took over this practice and, with the exception of the war years, has sponsored a contest each spring since 1938.

Four 15-minute talks were presented by members of the City College Chapter in this year's competition. The contestants and their subjects were: Harrison Kane, who spoke on "Cultural Courses for Engineers"; Robert K. Lockwood, whose subject was "Highway Legislation and Finance"; Walter B. Grossman, who discussed "Some Aspects of Photogrammetry"; and David B. Ehrenpreis, who spoke on "Analysis with Beggs Gages."

Harrison Kane, adjudged the winner, received a scroll from Mrs. McLoughlin. The meeting was conducted by William J. Armento, chairman of the contest committee.

Senate, House Labor Bills Held Favorable

AS SENATE AND HOUSE conferees moved toward reconciliation of differences in the labor bills passed by each, prospects were bright for elimination of difficulties which, in the past, resulted in involuntary inclusion of many professional men in heterogeneous labor organizations.

This word was received from E. L. Chandler, M. ASCE, Eastern Representative of the Society, Washington, D.C., who led the panel of engineers in a presentation before the Congressional committees when they were hearing testimony regarding amendments to the Wagner Act (CIVIL ENGINEERING for April 1947, page 44).

Current objective of professional men, Mr. Chandler pointed out, is to request the conferees to retain the Senate bill's definition of a professional employee, thus eliminating chance for confusion in later administration of the law. Senators on the Conference Committee are: Robert A. Taft, Ohio; Joseph H. Ball, Minnesota; Irving M. Ives, New York; James E. Murray, Montana; and Allen J. Ellender, Louisiana. Representatives serving are: Fred A. Hartley, Jr., New Jersey; Gerald W. Landis, Indiana; Clare E. Hoffman, Michigan; John Lesinski, Michigan; and Graham A. Barden, North Carolina.

Professional Activities Committee Is Authorized

ANOTHER STEP IN the process of devoting additional attention to the professional activities of the ASCE in the field of education was taken by the Board of Direction at the Spring Meeting in Phoenix. This followed a recommendation of the Executive Committee, which made a study of a report submitted earlier by an exploratory conference on engineering education.

The Board now has authorized a standing committee carrying the title, "Special Committee for the Coordination of Professional Activities." This committee will be made up of the Contact Members of the Society's Committees on Student Chapters, Local Sections, Juniors, Employment Conditions, Engineering Education, Salaries and Registration.

Board Rules on Use of Society's Emblem

RECENT FREQUENT INQUIRIES by members of the Society regarding the use of the ASCE shield or emblem on individual or consulting firm stationery prompted the Board of Direction to consider this matter at its Spring Meeting in Phoenix, with the result that the Board reaffirmed the following previously unwritten policy and made it a matter of record:

"That the Society emblem shall be used only on official Society stationery, including the stationery of Local Sections, Student Chapters, Society Committees, etc."

Committee to Report on Teaching Salaries

PURSUANT TO SPECIFIC INSTRUCTIONS from the Board of Direction, the Committee on Salaries has under way an investigation of the salaries paid in civil engineering teaching professions, with a view to later recommendations for proper and adequate compensation for such services.

The committee proposes to obtain basic data through a questionnaire constructed along lines designed to permit a point evaluation of teaching positions in the engineering colleges. The committee hopes to recommend to the Board at the summer meeting a scale of salaries for civil engineering teachers appropriate to the duties and responsibilities of each.

An attempt to fit teaching positions into the proper position or positions in the salary schedule adopted by the Board in 1946 is also proposed by the committee.

STUDENT AND THREE of his professors get together at Phoenix Spring Meeting for first time since his graduation from University of Michigan 35 years ago. Student is Raymond A. Hill, Los Angeles, left, Past-Director, ASCE, and professors are, left to right: Henry E. Riggs, Past-President and Hon. M. ASCE; Horace W. King, Hon. M. ASCE; and Lewis M. Gram, Director, ASCE.

ASCE Will Make Congressional Presentation on Stream Pollution Legislation

IN KEEPING WITH the action taken when the 1946 Congress considered legislation regarding the correction of stream pollution, the ASCE Board of Direction has authorized that a presentation be made before the 80th Congress now considering similar legislation. Action was taken by the ASCE Board at the Spring Meeting in Phoenix, at which E. L. Chandler, Washington, D.C., Eastern Representative of the Society, was authorized to present a statement to the Congress. The ASCE Committee on National Affairs was requested by the Board to cooperate with Mr. Chandler in the furtherance of the objectives set forth in the following statement, which was approved by the Board:

"The American Society of Civil Engineers is a scientific society composed of approximately 22,000 individual members. Included in the membership are many specialists in the field of sanitary engineering, and the Society has a Sanitary Engineering Division.

"We are deeply interested in the development of sound programs for eliminating and preventing polution of the streams and other waters of the country. It seems unnecessary to undertake any discussion of the need for active measures to free the public waters of the nation from the contaminating wastes that are being poured into them. Evil and unhealthful conditions that have developed are all too evident. Correction of these evils vitally affects health and welfare of the people of the nation.

"It is our view that maintenance of safe and adequate supplies of water satisfactory for domestic and industrial use is the problem of major importance in considering legislation directed toward correction of pollution of the country's streams. It is here that primary emphasis must be placed. Proper measures for protection of fish and wild life, and the interests of general conservation and recreation, are desirable but appear of secondary importance. With accomplishment of the major objective, the others will be reached automatically.

"There is much value in legislation that will lead to integration of activities of federal, state, municipal, and industrial interests; that will make provision for investigation and research leading to control of water pollution; and that will provide for the formulation of overall programs and recommendations by a federal agency.

"Careful study has been given to the provisions of S. 418 and the general principles of that bill are approved in so far as they can lead to constructive action to meet the above mentioned objectives. However, we direct attention of the Committee to certain of the proposals included which are not deemed appropriate.

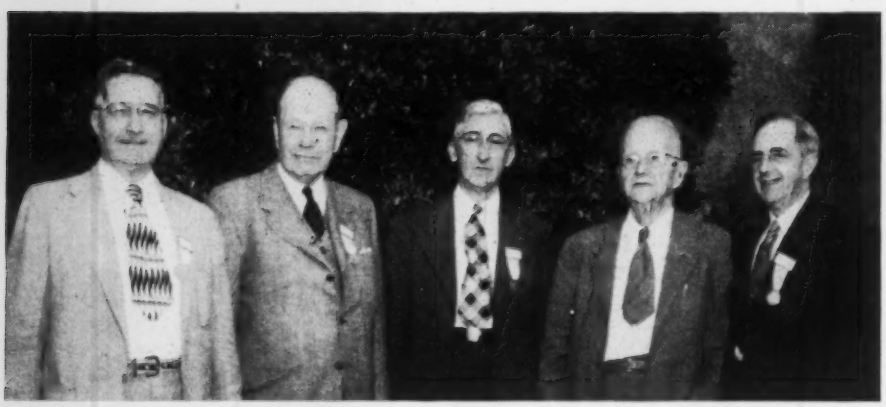
"We disapprove the provisions of Sec. 2(*d*) which make it mandatory to bring federal suits for abatement upon request of the Surgeon General, in the event that state authorities do not take steps that are appropriate in his opinion. Such action is considered unnecessary and unwarranted. Constructive programs of pollution abatement are currently effective in individual states and through joint state compacts in different parts of the country, and other programs are in process of formulation. We believe that the federal government should not embark on a course of punitive enforcement in this field but that its efforts should be confined to investigation, research and assistance to state and local governments in the formulation of programs adequate for the purpose of eliminating pollution.

"Sec. 5, coupled with Sec. 7(*d*), would establish specific provision for grants-in-aid for the construction of treatment works. We are opposed to this as a matter of general principle. However, in the event that Congress should, at some later date, make provision for federal grants for general public works construction, we recommend that sanitary engineering works be given high priority as being among the most vital to the public interest.

"As distinguished from grants for construction, we advocate federal financial assistance for purposes of investigation, study and report relative to proposed pollution control measures and for the advance planning of specific treatment works. The advance planning of local public works has become generally recognized as wise. The result of such planning is a substantial shelf of construction projects which may be released for construction when and as conditions indicate their urgency or the desirability of expanding the over all volume of construction throughout the country. Local communities frequently are precluded, by legislative restrictions, from undertaking the planning of a project until bonds for construction have been issued. Under such circumstances there is, inevitably, a long period of delay before construction can be started. Furthermore, the planning is very likely to be done under great pressure for haste, with a result that plans are not as carefully conceived as is the case when ample time is afforded. It is apparent that wherever federal assistance can lead to promptness in planning there is a corollary of better planning and of better timing of construction.

"Accomplishments under the current program of country-wide advance planning of local public works with federal assistance, as authorized by Title V of the War Mobilization and Reconversion Act of 1944, have demonstrated the practicability of this procedure.

"We believe that federal action, based on S. 418, modified in accordance with the foregoing recommendations, would provide a long-needed and valuable stimulus to progress toward correction of the evils of water pollution."



FOUR PAST-PRESIDENTS of ASCE appear at Spring Meeting in Phoenix with 1947 President E. M. Hastings, center. They are, left to right: J. C. Stevens, E. B. Black, Henry E. Riggs, and W. W. Horner.

Kansas Licensing Law Passed After Years of Effort by State's Engineers

ROBERT M. LINGO, JUN. ASCE
Publicity Chairman, Kansas State Section, ASCE

MANY YEARS OF EFFORT on the part of Kansas engineers were rewarded on April 10, 1947, when Governor Frank Carlson signed a bill making licensing of engineers compulsory in the state. Kansas has had a law providing for registration of engineers since 1931 but such registration has not been compulsory and has had little or no effect, although more than 650 engineers voluntarily registered to further the cause. Attempts made to revise and strengthen the 1931 law by inserting the word "shall" in place of "may" were defeated in the state legislature because the lawmakers felt that too many groups were trying to have a "closed shop."

In March 1946 the Kansas Engineering Council was formed by the four major engineering groups of the state: ASCE, County Engineers Association, Kansas Engineering Society, and Kansas Society of Professional Engineers. This council spent a great deal of time in research, going over the various state registration laws, the "Model Law," and recent developments in other states. It then worked to draft a bill so worded as to be acceptable to the Kansas legislature. Much time and effort were spent in finding a definition of "professional engineer."

The bill, passed with only minor changes, was actually written by engineers: C. H. Scholer, M. ASCE; Paul Haney, State Board of Health engineer; George Lamb, M. ASCE; H. H. Munger, Assoc. M. ASCE; and C. Y. Thomas, mechanical engineer.

After the bill had been presented on the floor of the house of representatives, further effort was needed to make it become law. Such "ramrodding" was done by the members of the council. ASCE members active in securing its final passage are: A. G. Aldridge, G. W. Bradshaw, W. L. Dyatt, George W. Lamb, Maloy Quinn, C. H. Scholer, J. B. Speigel, Robert M. Willis, and Murray A. Wilson.

The way the bill was finally put through shows how effectively this group worked. The Kansas legislature, widely noted for running overtime, worked right through Easter Sunday. During this period things moved fast. The engineers' bill had been passed by the house of representatives for some days when it appeared on the floor of the senate. Then, between 11:25 a.m. and 8:45 p.m. the bill was: (1) Taken up for consideration by the senate, (2) amended in several particulars, (3) returned to the house, (4) approved by the house, and (5) sent to the governor. Such work was accomplished by the Engineering Council members working with, and on, the members of the legislature. The bill, House Bill No. 32, will become law upon publication in the book of statutes, which will appear about July 1, 1947.

All engineers who were registered under the 1931 Kansas Law—more than 650 out of an estimated 1,500 to 2,000 engineers in the state—will be "licensed" under the new law. Henceforth engineers of the state will be licensed and not registered.

Some of the more important items of the new law are: (1) It puts the responsibility on the man who offers his services as an engineer, rather than on a firm or board who hires him. (2) Only licensed professional engineers may use the title or practice professional engineering in Kansas. (3) There is a "grandfather" clause. (4) Architects, not architectural engineers, are exempt. (5) Licensed engineers of other states may obtain a Kansas license for $10. (6) A procedure is established for revoking a license. (7) Aircraft and sales engineers are exempt. (8) The law excludes men who design and erect structures for personal use, when such structures cost less than $30,000, and it excludes design of products which are manufactured for resale.

Under the new law the qualifications of a professional engineer are, in general: (1) Graduation from an engineering college, or (2) eight years of engineering experience plus a written examination, or (3) twelve years of experience and attainment of age 35.

There will be a "Board of Engineering Examiners" composed of five members, each appointed by the governor, "who shall consider nominees recommended by the representative engineering societies having a state-wide organization." If this section of the law is adhered to it should provide a truly representative engineering board. The law as passed requires the members of the board to have five years of engineering experience, whereas the Kansas Engineering Council had asked for a minimum of twelve years of experience.

Photo by G. E. Schrock

COMPULSORY LICENSING of Kansas engineers is provided for by House Bill No. 32, signed by Governor Frank Carlson on April 10, 1947. Standing, left to right, are: Claude C. Bradney, engineers' legislative representative; Representative Walter McGinnis, who introduced bill in house of representatives; Senator Hal Harlan, who handled bill in senate; and C. Y. Thomas, president, Kansas Engineering Council.

Two New Student Groups Bring ASCE Total to 125

ADDITION OF TWO new Student Chapters was authorized by the Board of Direction at the Spring Meeting in Phoenix on recommendation of the Committee on Student Chapters, bringing to a total of 125 the number of ASCE Student Chapters.

New Chapters were authorized at Wayne University, Detroit, Mich., and at the University of Alaska at College, Alaska, the latter to be known as the Yukon Student Chapter.

What Management Expects of an Engineer

A. C. RUBEL
Vice-President, Union Oil Co. of California

REPRESENTING top management in the oil industry Mr. Rubel's remarks on "What Management Expects of an Engineer" apply equally well to other fields. Young civil engineers will find valuable suggestions on working their way to top positions in these excerpts from an article published in the April 1947 issue of *Mining and Metallurgy*.

WHAT DOES MANAGEMENT expect of and from an engineer? First and foremost, it expects that he should become, and therefore should fit himself in every way to be, a part of management so that he may assume as much and as many of the responsibilities of management as his ability and the opportunities of the job permit.

The profession of pure, technical engineering offers but limited opportunities at the top levels because of the inherent organization of engineering work. The line of succession to top jobs may be likened to a cone with a broad base and an extremely sharp point. The road to these jobs is a long one and the competition is tough. The larger the organization the greater the opportunity, but always the ratio of engineers to top engineering jobs is small.

May I draw the important distinction between the engineer who, by education, training, and experience is fitted to discharge fully the duties and responsibilities of his job, and the engineering graduate or the man with engineering training who is serving his apprenticeship. It is to the latter that I particularly wish to address these remarks.

Sound Background Needed

Management expects an engineer first to have a sound and fundamental educational background and then to learn his business from both the technical and the practical side. You may call it apprenticeship, a trainee program, or just plain experience, but most managements and most engineers who have served such a course will agree that without this experience in greater or lesser degree, an engineer cannot be of maximum value to his company.

Secondly, management looks on the young engineer, particularly, as the raw material from which the technical, much of the operating, and certainly no small part of the executive and managerial supervision of a company must be developed. Management should undertake to provide the means by which this material may be trained and developed along lines to which the individual is best suited and for which the company has most need. Some young men will not finish such a course either because they feel that their engineering talents are not properly appreciated and utilized, or because they realize that they are not fitted, temperamentally or otherwise, for the game.

Third, management expects the engineer, in addition to his technical and operative knowledge and skill, to learn the most difficult and perhaps the most important of all lessons in modern industry—human relations, the art of handling men.

No matter what the technical or experience qualifications of a man may be, no matter if he be the best technician, the most versatile engineer, or the most skillful operator, his opportunities for advancement are decidedly limited if he cannot get along with men. If I were asked to name the single most valuable characteristic for advancement in industry I should unhesitatingly name this one.

Fourth, management expects the engineer to work. Neither the job of engineering, operating supervision, nor executive management can be successfully handled in an 8-hour day or a 5-day week. Scheduled time applies to routine operations and likewise scheduled operations apply to routine men. You may look with envy at the tour operator who "shuts her down" after 8 hours while you are still on the job with no break in sight, but that's just one of the differences between your job and his. If you are looking for a 40-hour week stay out of engineering—at least in this business.

Fifth, management expects the engineer to learn to think—to think independently, and originally, and not in "quotes." This is likewise a tough assignment and not everyone, by any means, can master it. In our industry, engineers, both young and old, have too much tendency to let someone else do the thinking and then to apply those thoughts instead of their own. Our technical literature is rich in good sound thinking, thinking which has and is resulting in great strides in the better understanding of our many complex problems and operations. Unfortunately, we are also plentifully supplied with some bad thinking which, when dignified with publication in technical journals, can easily deceive the unwary and be substituted for good thinking.

It is highly desirable for the engineer to keep up to date on contemporary technical literature, but it should be a basic part of his philosophy to take nothing for granted and to scrutinize, in the critical light of his own knowledge and experience however limited that may be, every conclusion developed, no matter how celebrated the authority or well known the publication, before adopting it as his own. Unless an engineer can cultivate the ability to think independently he is doomed to mediocrity and must be content with the status of a technician, even though he may be classified as an engineer.

An engineer should be an active member of one or more technical societies in the fields of his chosen interests. He should participate in their discussions and contribute to their literature if there are worthwhile subjects upon which to write. Management will usually encourage this with time and facilities.

Constructive Criticism Is Stimulating

Sixth, an engineer, and particularly a younger one, is expected to do a certain amount of crabbing and bellyaching and to feel a bit abused and unappreciated at times, but he is also expected to do something about it, not just be content with the luxury of crabbing. Nothing is more stimulating to management than constructive criticism or dissatisfaction with current practices and results, but there is nothing worse than that same criticism, even though it be constructive in its inception, unless it be followed by action by the critic in an attempt to remedy the supposed faults.

Supervisors are, as a rule, busy men, occupied with their own problems. Unless they are unusually responsive, the natural reaction to any new idea is negative, or at least a new idea is viewed with skepticism. This is perfectly natural. It is up to the engineer either to put over his idea by demonstrating its merits or to find out the reason why it is not acceptable.

I know of numerous instances where the services of engineers have been terminated for a conspicuous lack of ideas and perseverance but I can recall no cases of such termination where the engineer was producing, even though his superiors may have become much annoyed with his persistence.

The executive must take the engineer's conclusions, uncertain as they may be, and combine them with other considerations under the general heading of business judgment. From such a deliberation he must reach a decision which may mean the investment of millions of dollars of stockholders' money, and on the results of such investment he must stand or fall. There are no acceptable alibis for poor business judgment. If the executive group fails to operate in a manner satisfactory to the directors and stockholders, a new group of

facts may be expected on the executive committee.

Seventh, management expects an engineer to assume his duties and responsibilities as a citizen, to take an interest in the political, social, and civic affairs of his community. Technical and scientific developments are far outstripping the political and social ability to absorb or utilize them, or in fact, as witness the developments in nuclear physics, to even control them. Of what use is technical development if we cannot apply it for the benefit and not the destruction of mankind? Politicians, statesmen, lawmakers, soldiers, and past and present leaders of business and industry have proved rather conclusively their inability to adapt our society and our economy on a national scale to technological advances.

Get into civic life and make your knowledge and your ideas felt. If we had more engineers on school boards, on planning commissions, as councilmen and supervisors, we would not see the waste and muddling inefficiency, graft, and confusion that characterize our governmental bodies from city council to Congress.

Eighth, management believes in and wants the engineer as an integral part of that management, and as such he must give it his undivided support and loyalty. There can be no room for a union, collective bargaining agency, or any other alienating influence under such an arrangement. Modern trade unionism has as its fundamental basis the objective of gaining security for its members. It accomplishes this at the expense of opportunity and freedom for the individual. It reduces its members to a common denominator, often the least common denominator. A bricklayer is a bricklayer in modern trade unionism and draws bricklayer's pay whether he can lay 400 or 1,200 bricks in a day. In many instances the man's production is completely controlled by the union itself so the best man of the group is geared to the pace of the poorest. An engineering union must eventually come to a similar result. This violates every basic principle of the profession.

Unions may serve a necessary purpose among certain men but as an engineer if you are worth a tinker's damn, you must be far more concerned with opportunity than with regimented security. An engineer's creative thinking cannot be regimented, or his efforts or working hours prescribed and limited, without reducing him to that drab status of a routine technician with artificially limited creative opportunity and little or no incentive.

If you are to be a part of management you cannot serve two masters, you cannot represent your company on one hand and be subservient to your union on the other. If you are so foolish as to try, you are simply condemning yourself to mediocrity and a new level of technical supervision will be set up as an integral part of management and independent of regimentation and divided affiliation. You will not be in it.

Ninth, management expects the engineer to be adequately compensated for his job. How this compensation is determined varies greatly within the industry, and the adequacy of the pay is likewise a function of the personal thinking of the recipient. Again may I warn against the attempt to standardize pay either by collective action or by the misguided efforts of some of our industrial relations experts. Once regimented it will stay that way.

John Suman, as vice-president of the Humble Oil and Refining Co., is reported to have evolved a standardized summation for all young engineers entering the services of that company. He said to them "Your job is to get my job." This, I believe, is the best summary management can make of what it expects of engineers.

Manuscripts Deposited in the Engineering Library

TECHNICAL PAPERS RECEIVED BY ASCE in excess of those that can be included in its publications are deposited at intervals in the Engineering Societies Library, where they are available to those interested. Brief résumés of four papers thus made available to those who have access to the Library are given below.

The Collection and Disposal of Refuse, Lower Merion Township, Pa., by Walter E. Rosengarten, M. ASCE. This paper, delivered at the Philadelphia Meeting of the Society, April 1946, deals with municipal handling of wastes, including garbage, ashes and other materials, each under a separate method. Setup of staff, equipment, and costs are given, with notes on operation. Incineration, dumping and outside hog feeding are utilized. This is a suburban community 24 sq miles in area and of 45,000 population. Ten manuscript pages total about 4,000 words plus two diagrams.

The Hydraulics of Water Wells, by Carl Rohwer, M. ASCE. This is a summary of essential data collected from many sources. It discusses the factors that influence the discharge of wells and their water-bearing formations, and the formulas that show the relation of these facts to the discharge. Twenty-nine pages of manuscript include about 7,000 words plus four diagrams.

Adjustment of Suspension Bridge Cables, by S. O. Asplund, Sweden. To enable an exact erection that eliminates need of adjusting the main hangers of a suspension bridge, an analytical method is given, with numerical examples illustrating the necessary precalculation. The manuscript contains seven pages of mathematical text—about 2,000 words.

"Improvements in Uplift Investigation Methods:—The Circle Method for Flow-Net Diagrams; Interdependence Between Seepage and Scour," by S. Leliavsky Bey (Egypt). Instead of use of squares to construct a flow net, the advantages of tangent circles are stressed; their position and size are determined by certain auxiliary circles. A number of examples are taken from the author's hydraulic and laboratory experience in Eygpt. The latter half of the manuscript is devoted to a study of the required depth of downstream sheet piling to protect a barrage against the combined danger of erosion and undermining. Fifty-four pages of manuscript contain about 9,000 words, plus 31 illustrations, mostly large diagrams.

EJC Elected to Join UNESCO Advisory Body

ENGINEERS JOINT COUNCIL is one of seven organizations elected to fill remaining seats on the National Commission for Educational, Scientific and Cultural Cooperation, according to a State Department announcement. Selection of these organizations was made by the executive committee of the Commission, which met in Washington May 9. In addition to EJC, the new organizations chosen for representation on the Commission are: American Association of School Administrators, American Association of Teachers' Colleges, American Chemical Society, Modern Language Association, National Council for the Social Studies, and National Institute of Arts and Letters.

The election raises to 57 the number of organizations that will be invited to name representatives to the National Commission. Selection of three other organizations at a later date will complete the roster of 60 authorized by Congress. The duties of the Commission are to advise the government on UNESCO (United Nations Educational, Scientific and Cultural Organization) matters and ensure national cooperation in UNESCO programs.

Election of EJC to the Commission will give engineers a voice in international affairs.

Leon S. Moisseiff Award in Structural Analysis Field Is Authorized

A NEW SOCIETY AWARD—the Leon S. Moisseiff Award for excellence in the field of structural analysis—was authorized by the Board of Direction at its Spring Meeting in Phoenix. The Board accepted the offer of the Leon S. Moisseiff Memorial Committee, of which ASCE Director Shortridge Hardesty, New York, was chairman.

The committee offered a sum of not less than $4,000, an estimated $1,000 of which would be available to meet preliminary expenses for dies, engravings, etc., leaving approximately $3,000 for a trust fund sufficient to support the award out of earnings.

The award, in memory of the late Leon S. Moisseiff, M. ASCE, is to be made for an important paper in the current volume of TRANSACTIONS, or any volume since the last award, dealing with the broad field of structural design—including applied mechanics, as well as the theoretical analysis—or constructive improvement of engineering structures, such as bridges and frames, of any structural material. Open to non-members, as well as members, of the Society, the award will not be given to papers recognized for award of other Society prizes. The Prize Committee may designate a "second order of merit" in any year when the excellence of more than one paper justifies such action, and a paper so recognized will be considered eligible to compete in the award for the next succeeding year.

Subject to ratification by the Board of Direction, the Executive Committee of the ASCE's Structural Division will select the recipient of the Award, which will consist of a bronze medal and an appropriate certificate signed by the President and Executive Secretary of the Society.

Mr. Moisseiff died at his summer home at Belmar, N.J., on September 3, 1943, at the age of 70. He had served as consulting engineer or designer on practically all the bridges connecting New York's five boroughs and on such spans as the Golden Gate Bridge at San Francisco, the Ambassador Bridge at Detroit, and the Delaware River Bridge at Philadelphia. He was the author of numerous volumes on bridge design and engineering, and the recipient of the Society's James Laurie Prize and the Norman Medal.

Student Chapters Honored for 1946 Activities

IN RECOGNITION OF outstanding activities during 1946, a selected number of ASCE Student Chapters have been cited for special commendation. The honors have been awarded, following action by the Society's Board of Direction at its Phoenix meeting.

The Board's action has been relayed to the 29 Chapters selected, in the form of engrossed Certificates of Commendation and President's Letters of Honorable Mention. The Chapters receiving the Certificates and their geographical distribution are:

Northeastern Region
- Manhattan College
- Massachusetts Inst. of Technology
- University of Connecticut

Middle Atlantic Region
- Carnegie Institute of Technology
- Ohio Northern University
- West Virginia University

Western Region
- University of California
- Texas A. and M. College
- University of Colorado

Southern Region
- University of Kentucky
- Virginia Military Institute
- North Carolina State College

North Central Region
- Missouri School of Mines
- Iowa State College
- Rose Polytechnic Institute

The President's Letters of Honorable Mention go to other Chapters, as follows:

Northeastern Region
- Syracuse University
- Northeastern University

Middle Atlantic Region
- Case Institute of Technology
- Newark College of Engineering
- Pennsylvania State College

Western Region
- University of Wyoming
- University of Utah
- Stanford University

Southern Region
- Louisiana State University
- Virginia Polytechnic Institute
- Vanderbilt University

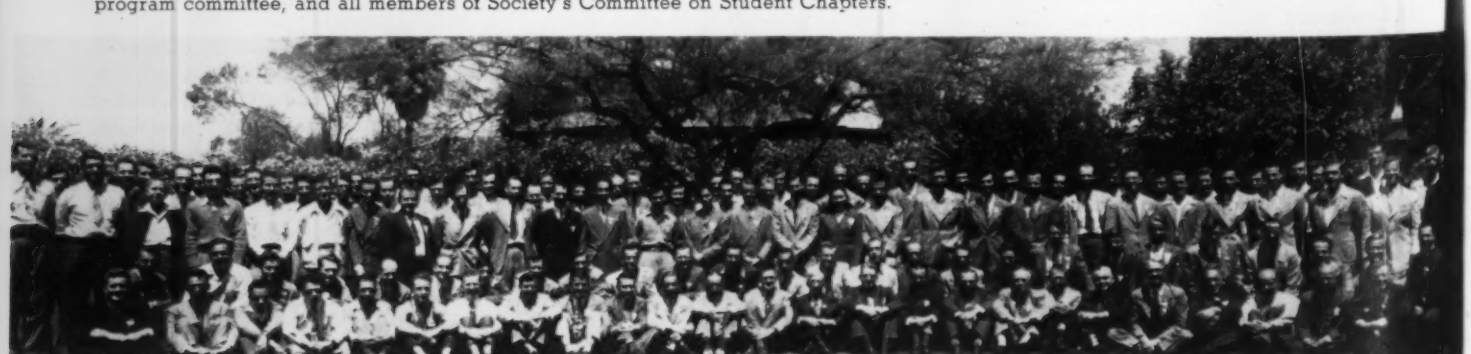
North Central Region
- South Dakota State College
- Washington University
- Marquette University

Cleveland Section Has Active ASCE Wives Group

MOTIVATED BY THE desire to know more about their husbands' profession, the ladies of the Cleveland Section have a highly successful organization called the ASCE Wives. The group was started in 1944, when the Cleveland Section was preparing to be host to the Annual Convention of the Society. Plans had been made and committees of women—under the chairmanship of Mrs. Charles H. Splitstone—set up to entertain the visitors, when the Office of Defense Transportation suddenly canceled the Convention.

Well organized and ready for action, the women decided to make the temporary convention group into a permanent organization, patterned after the constitution of the Cleveland Section. The group decided that its primary objectives would be to cultivate friendly relations among the members of the Section and their families, and to promote a lay knowledge

ALTHOUGH INDIVIDUALS MAY NOT BE RECOGNIZED, presence of 122 members and students attests success of Phoenix Student Chapter Conference. Included are President Hastings (seated, front row near center), Director John H. Gardiner, chairman of technical program committee, and all members of Society's Committee on Student Chapters.



of civil engineering among the Wives. Instrumental in forming the organization were Mrs. Splitstone, Mrs. Mark Swisher (elected first president of the group), Mrs. Robert McDowell, Mrs. C. H. Fowler, Mrs. J. F. C. Shafer, Mrs. F. C. Tolles, and Mrs. George Barnes.

The present schedule of activities calls for six monthly luncheon meetings, starting in October. There are no meetings in December or January, but the Wives usually attend the Section's annual meeting in January. Featuring speakers from their own ranks, the women usually discuss their husbands' occupations. There is unanimous enthusiasm for the work of presenting such talks on subjects of engineering interest. Special activities, in addition to the meetings, have included several field trips, and the recent presentation of a $50 scholarship award to William B. Farmer, Navy veteran and a member of the Case Institute of Technology Student Chapter.

Officers of the ASCE Wives are Mrs. Robert McDowell, president; Mrs. George Barnes, vice-president; and Mrs. W. C. Fisher, secretary-treasurer. Mrs. Russel E. Takken is publicity chairman of the group.

J. Waldo Smith Fellowship Open Until July 1, 1947

ITS SCOPE having been extended by the committee in charge, the J. Waldo Smith Fellowship for promoting research in the field of experimental hydraulics will be open to applicants until July 1, 1947. Choice is given between two lines of research, the requirements of which are outlined as follows:

1. Determine a practical working relation between diameter of pipe, slope of pipe downward in the direction of flow, slope of hydraulic gradient, average velocity of flow, and possibly other variables, and ability of the velocity to carry air bubbles along and prevent accumulation of air at a high point in the line; also determine the rate of correction or the degree of certainty with which an increased velocity will entrain and remove the air after it is once accumulated. Lucite pipe is suggested, including a tangent run on the adjustable slope, preferably not less than 10 ft long, and a bend of radius preferably not less than 25 diameters, and long enough to permit a wide range in the adjustment of the tangent slope. The air should be fed into the line on the upgrade ahead of the high point under minimum pressure so as to avoid as much as possible any help from entrainment of the air at the entrance point and so as to simulate a gradual movement of air along the top of the pipe toward the high point. It is desirable to include large diameters but difficulty in securing and using them may limit the size to 20 in. Preferably, as many as six sizes should be used extending to as little as 4 in. in diameter to establish the proper relationships.

2. Determine, in the case of a discharge of water through a nozzle into a body of still water, a practical working relation between the size and velocity of the nozzle and the size and form of the stilling pool, and the most efficient form and arrangement of nozzle, etc., to best absorb the energy of the discharge. It is desirable to cover a range of discharges and velocities up to the highest practicable rate allowed by the laboratory equipment. Maximum rates of not less than 20 cfs and 60 fps are desirable.

Foreign Exchange Rate Dues Credit Canceled

AT AN ESTIMATED saving of $2,000 annually, the ASCE will discontinue its practice of sharing on a 50-50 basis the cost imposed on members residing in foreign countries by adverse exchange rates. This was decided by the Board of Direction at the Spring Meeting in Phoenix on recommendation of the Executive Committee, which studied the policy put into effect as a temporary measure in the late thirties.

Effective with the 1948 dues, all members residing in foreign countries will be required, regardless of exchange rates, to pay the full amount of Society dues and other obligations.

Highway Construction Urged by Alabama Section

CONSTRUCTION OF FOUR-LANE superhighways on the several interstate routes in Alabama was urged by the Alabama Section in a motion adopted at its spring meeting on April 25. The motion, which was introduced by Erskine Ramsay, M. ASCE, was unanimously endorsed by the Section and sent to the governor of the state.

Pointing to the present congestion of the main arterial highways in Alabama and to the fact that bordering states are carrying out far-sighted highway construction programs, the resolution calls for the ultimate construction of four-lane highways on the several interstate routes, notably U.S. 31, U.S. 11, U.S. 78, and U.S. 80. In the opinion of the Section, improvement of these routes will attract additional through traffic and result in economic benefits to the state.

Plans for Highway Safety Conference Are Completed

THE SAVING OF at least 10,000 lives a year, with a proportionate reduction in injuries and economic loss, is the minimum goal of the President's Highway Safety Conference, to be held in Washington, D.C., June 18–20. In charge of arrangements for the session will be Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator, who served as chairman of the 1946 conference.

As one of the national organizations participating in the 1946 conference, the ASCE will be represented at the forthcoming meeting by Past-President W. W. Horner and Executive Secretary William N. Carey.

In cooperation with the Association of Casualty and Surety Executives, the President's Highway Safety Conference will launch a 13-week educational program designed to reduce traffic accidents. Publication of the program in the press of the nation will begin the week following the President's Highway Safety Conference and continue through the week of September 15.

Society Appointments

THREE APPOINTMENTS were made by the Board of Direction at the Spring Meeting in Phoenix:

PRESIDENT E. M. HASTINGS was elected a member of the John Fritz Medal Board of Award for the term beginning October 1, 1947, and ending September 30, 1951.

JOEL D. JUSTIN, M. ASCE, chairman of the ASCE Power Division's Executive Committee, was named to succeed himself as the Society's representative on the Engineering Foundation Board for a four-year term beginning October 1, 1947, and the ASCE Board recommended his election to the Engineering Foundation Board.

FRANK T. SHEETS, JR., Assoc. M. ASCE, Osborn, Ohio, was appointed as the ASCE representative on the Sectional Committee on Safety in Welding and Cutting of the American Standards Association.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

SUMMER CONVENTION
Duluth, Minn., July 16–18
(Board of Direction meets
July 14–15)
FALL MEETING
Jacksonville, Fla., October 15–17
(Board of Direction meets
October 13–14)
ANNUAL MEETING
New York, N.Y., January 21–23
(Board of Direction meets
January 19–20)

Coming Events

Florida—Meeting at the Seminole Hotel, Jacksonville, June 12, at 7 p.m. Prof. C. D. Williams, of the University of Florida, will speak on engineering education.

Lehigh Valley—Twenty-fifth anniversary meeting at the Hotel Bethlehem, Bethlehem, Pa., June 10, at 6:30 p.m. ASCE President E. M. Hastings will be the principal speaker.

Nashville—Dinner meeting at the Maxwell House Hotel, Nashville, June 5, at 6 p.m. Wales W. Wallace, resident engineer for Polk, Powell & Hendon, Birmingham, Ala., will speak on the proposed sewerage collection system for Nashville and vicinity.

Philadelphia—Dinner meeting at the Bala Country Club, Philadelphia, June 10, at 6:30. Roger Conant, curator of the Philadelphia Zoological Garden, will speak on "Modern Designs for Zoos."

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

San Diego—Dinner meeting at the U.S. Grant Hotel, San Diego, June 26, at 6:30 p.m.

Tennessee Valley—Meeting of the Knoxville Sub-Section at the S. & W. Cafeteria in Knoxville, June 11, at 6 p.m.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel Dallas, June 2, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, June 9, at 12:15 p.m.

Tri-City—Dinner meeting at the Muscatine Hotel, Muscatine, Iowa, June 5, at 6:30 p.m. Panel of members of Stanley Engineering Co. will discuss "Airport Design and Construction."

Wisconsin—Ladies' Night at the Plankinton Hotel, Milwaukee, June 26, at 8:30 p.m. Juniors will be in charge of the meeting.

Recent Activities

CENTRAL OHIO

PRESENT-DAY DIFFICULTIES IN providing new highway facilities include costs 60 percent above 1940 prices, Murray D. Shaffer, director of highways for Ohio, told the members of the Section at their April dinner meeting. Speaking on the proposed traffic interchange at the intersection of Spring and Sandusky streets, Columbus, Mr. Shaffer pointed out that the project, as conceived in the late '30's, was estimated to cost $1,000,000 and involved the county and railroads only. Today it involves four railroads, the Public Roads Administration, the state, the county, and the city of Columbus, and the estimated cost is $2,600,000. According to traffic studies, the interchange must provide for 30,000 vehicles a day in the north-south direction and 25,000 going east and west.

CENTRAL ILLINOIS

PLANS FOR THE relief of traffic congestion in and about Chicago were discussed at the April 30 dinner meeting, which was held in Springfield. Speakers were James F. Kelly, assistant chief engineer of the Cook County Highway Department, who outlined the proposed superhighway program for Cook County; and Dick Van Gorp, chief engineer for the Department of Subways and Superhighways, City of Chicago, who described the layout and details of planning of the Congress Street superhighway. A technicolor film on superhighways, loaned by the Portland Cement Association, concluded the program.

COLORADO

A PANEL OF ENGINEERS with the Public Service Company of Colorado—Raymond E. Davis, Larry Card, and Ted Neelands—outlined the various phases in the rehabilitation of Barker Dam, near Denver, at a recent meeting. It was pointed out that the dam, which was completed in 1910, was designed without provision for uplift and therefore lacked in stability. Rehabilitation of the project, which is now under way, consists of placing a precast slab 8 ft upstream and anchoring it to the present face of the dam, the space between the slab and the face of the dam to be filled with aggregate and grouted. This method was chosen as giving minimum interruption to storage.

DAYTON

THE PROBLEM OF POLLUTION as it affects Dayton and the Miami Valley was described by M. W. Tatlock, sanitary engineer for the Ralph L. Woolpert Co., at the April meeting. Pointing out that there is considerable pollution and contamination of local streams, the speaker emphasized the fact that the situation is injurious to industrial enterprises, public health, and recreational facilities. Showing of the film, "Clean Waters," prepared by the General Electric Co. as its contribution to the national anti-pollution campaign, concluded the program.

FLORIDA

IN A TALK ON present-day materials of construction, at the May 8 meeting, Howard See, district manager of Armco Drainage & Metal Products, Inc., stated that the present trend toward lighter and more streamlined designs necessitates the use of lighter materials. A great variety of such materials is available to the modern designer and builder, he said, and these materials are stronger than the heavier materials of the past. At another recent meeting, foundation problems encountered on a number of construction projects were described by Howard D. Oliver, district manager for the Raymond Concrete Pile Co., at Atlanta, Ga.

GEORGIA

PRINCIPAL SPEAKER AT the May meeting was Paul L. Andrews, executive secretary of the Georgia Highway Contractors Association and former captain in the Navy. Discussing some of the critical stages of our war against the Japanese from an engineering point of view, the speaker emphasized the importance of the work of the Seabees.

HAWAII

A LARGE PART OF Honolulu is still without sewers, Harrison P. Eddy, Jr., of the Boston firm of Metcalf & Eddy, reminded members of the Section at a joint dinner meeting with the Engineering Association of Hawaii. Speaking on "Plans for the Collection and Disposal of Honolulu Sewage," Mr. Eddy discussed the $21,000,000 sewer system and disposal plant that his organization and the Honolulu firm of Austin & Towill have designed for the city. The proposed new trunk sewers were described by Robert Mowry, of the local firm. Later a joint resolution, urging the implementing of the work, was adopted by the Section and forwarded to the municipal officials and territorial legislature.

ILLINOIS

The aerodynamic stability of suspension bridges was discussed by F. B. Farquharson, professor of civil engineering at the University of Washington, before a well-attended joint meeting with the Western Society of Engineers. The speaker made the point that there are two schools of thought in regard to proper procedure in the design of suspension bridges. One believes it should be accomplished by providing sturdy stiffening girders, while the other is of the opinion that it can be done more economically by studying the aerodynamic stability of various types of cross sections and choosing the most favorable.

IOWA

In a recent talk before a joint meeting with the Iowa State College Student Chapter, L. E. Sandvall, of the District Engineer's Office at Omaha, Nebr., described the use of the Bailey Bridge on the Ledo Road in Burma. During the war, Mr. Sandvall was in charge of Engineer troops that built a suspension bridge, with a clear span of 450 ft, on the Ledo Road. This, he said, was the largest suspension structure using Bailey Bridge units that has been built.

INDIANA

Members of the Section participated in a recent all-day meeting of the Indiana Engineering Council. Programs for Council meetings are developed by assigning various member organizations a certain amount of time on the program. The Section was responsible for a talk on "German Building Materials and Construction Methods," given by Fred I. Rowe, chairman of the Market Development Committee of the Associated General Contractors, Columbus, Ohio, and discussed by M. A. Swayze, of the Lone Star Cement Corp., New York City. Lewis S. Finch, president of the Section, presided at the civil engineering session and served as toastmaster at the joint banquet held in the evening.

KANSAS

Citing the increased services the Society now performs for its members, ASCE Mid-West Representative George S. Salter, addressed a recent meeting on the need of increasing dues. In particular, he referred to the efforts of the Society to improve the economic and social status of the engineer and described ASCE participation in EJC and other group activities.

KANSAS CITY

Former ASCE Vice-President E. E. Howard discussed the two proposed amendments to the constitution at a recent meeting. In pointing out the need for an increase in dues, Mr. Howard drew a parallel between present-day increased construction costs and the increased cost of the Society's services to the members. The technical program consisted of a talk by John A. Short, engineer in charge of the Missouri State Highway Department of Resources and Development, who described the functions of his department, emphasizing the importance of interrelationships in the development of various resources.

Under the sponsorship of the Junior Activities Committee, the Juniors of the Section held an organizational meeting recently and decided to undertake a series of meetings for the discussion of technical subjects. At the first of these projected sessions, C. K. Martin, Jun. ASCE, read a paper on methods of analyzing indeterminate structures and their interrelationships. A panel of corporate members—including Josef Sorkin, G. V. Nelson, J. B. Marshall, and Prof. G. W. Bradshaw—discussed the paper.

LEHIGH VALLEY

Construction in record time of the Navy's vast fleet of advance base floating drydocks was covered by Capt. James T. Reside, U.S.N., at the April meeting. As wartime head of the Navy's expanded Drydock Section, Captain Reside was in charge of its tremendous floating and graving drydock program. For his work in this connection, he received a citation from the Secretary of the Navy and a decoration from the British government. The attendance of 250 included many members of the Student Chapters at Lafayette College and Lehigh University.

TWENTY-SIX MEMBERS ATTEND LOCAL SECTIONS CONFERENCE AT PHOENIX. Seated left to right: John A. Focht, Austin, Tex.; Conrad M. Blucher, Corpus Christi, Tex.; Norbert Leupold, Portland, Ore.; F. W. Robison, Sacramento, Calif.; J. E. Lothers, Stillwater, Okla.; T. H. Campbell, Seattle, Wash.; John A. Baumgartner, Tucson, Ariz.; R. W. James, Denver, Colo.; Walter E. Jessup, ASCE Western Representative, Los Angeles; Ray L. Derby, Los Angeles; and Fred C. Scobey, Berkeley, Calif. Standing left to right: E. Lawrence Chandler, ASCE Eastern Representative, Washington, D.C.; John Server, editor, "Western Construction News," San Francisco; C. E. Andrew, Tacoma, Wash.; C. R. Moore, Spokane, Wash.; Ralf R. Woolley, Salt Lake City; Herbert Yeo, Albuquerque, N.Mex.; P. M. Johnson, Helena, Mont.; H. R. McDonald, Phoenix; D. P. Reynolds, assistant to the Secretary, ASCE, New York City; George E. Brandow, Los Angeles; C. R. Compton, Los Angeles; J. E. Rinne, San Francisco; T. A. Binford, Los Angeles; S. T. Harding, San Francisco, and P. W. Helsley, San Diego.

LOUISIANA

THE GEOGRAPHY OF a region should be considered in any engineering assignment, according to Dr. Richard J. Russell, assistant director of the school of geology at Louisiana State University. Addressing a recent meeting of the Section on "The Geography of Louisiana," Dr. Russell pointed out that the state has four distinct types of coast line and cited the effect of river locations during past ages on present foundation problems. Discussion of his talk was led by Stanley McDonald, chief geologist of the Louisiana Land and Exploration Co., Houma, La. During the evening, the Section unanimously adopted a resolution opposing pending legislation that would place sanitary engineers and engineering functions, now in the Sanitary Corps, in a "Medical Service Corps."

MARYLAND

ALTHOUGH THE IDEA of precast concrete is not new, wartime applications of the principle introduced many innovations, A. Amirikian, principal engineer in the planning and design department of the Bureau of Yards and Docks, told members of the Section at their April dinner meeting. In a talk on precast concrete structures, Mr. Amirikian described the wartime work of the Navy in that field. Innovations included pouring separate sections of structures in the flat and connecting them by the use of dowels and grout. This procedure enabled the building of concrete slabs less than an inch thick, an impossibility when conventional methods of pouring are employed. Success with precast floating structures led the Navy to experiment with a similar type of construction for large storehouses, Mr. Amirikian stated, prophesying that the method will soon be used in housing construction.

MICHIGAN

SPEAKING ON THE PROPOSED constitutional amendments at the April dinner meeting, George S. Salter, ASCE Mid-West Representative, stressed particularly the necessity for raising Society dues. A talk on "The Origins of Weights and Measures"—by Paul Van Buskirk, location engineer for the Huron-Clinton Metropolitan Authority—comprised the technical program for the occasion. An enthusiastic discussion followed Mr. Van Buskirk's explanation of the various numeral systems and their relationships to units of weight and measure.

MID-MISSOURI

PRESENT ASPECTS OF the development of water resources in Missouri were covered by John A. Short, water engineer of the Missouri Resources and Development Department, at a joint meeting with the Rolla chapter of the Missouri Society of Professional Engineers. The speaker reviewed the Pick-Sloan plan for the development of the Missouri River basin, especially as it affects Missouri, and said that the state and civic organizations are opposing certain phases of the plan. As a result of this opposition, Mr. Short stated, the Army Engineers have agreed to make a new joint study in cooperation with interested federal and state agencies.

MEMBERS OF MIAMI SECTION INSPECTING NEW Rickenbacker Causeway are photographed on bascule span. Reading left to right: Messrs. Manfred, Young, Morrison, Philips, Baker, Emery, Clarke, Friedman, Gorman, Lindholm, Felkman, Edwards, Bogart, Spaudling, Buell, Rader, Babcock, McKay, Herrick, Gordon, Perry, Shand.

MIAMI

A RECENT INSPECTION TRIP to the Rickenbacker Causeway and Crandall Park Project on Virginia and Biscayne Keys attracted a good attendance. The causeway, now nearing completion, is a four-mile sand-filled embankment carrying a four-lane highway over Biscayne Bay and connecting downtown Miami with the undeveloped key land fronting on the Atlantic. The project included construction of a Bascule-type movable bridge for passage of high vessels, and several thousand feet of low-clearance girder-span bridges. Almost 3,000 acres of undeveloped ocean-front land will be opened to the public for commercial and recreational purposes by the causeway. Construction is being handled by Dade County at an estimated cost of over $4,000,000. Members attending the annual convention of the Florida Engineering Society early in May had a joint luncheon with that group and the Florida Section. During the convention, M. B. Garris was elected president of the Florida Engineering Society, succeeding Edmund Friedman. Both are active in the Miami Section.

MONTANA

A SYMPOSIUM ON AIRPORT design and construction comprised the technical program at the regular April meeting, which was held in Helena. Participants were Charles S. King, district engineer for the Civil Aeronautics Administration in Helena, who described the procedure involved in selecting airport sites; Thor Rivenes, paving engineer for the CAA, who outlined the investigations made at the site to determine the proper design; and Fred E. Thieme, district engineer for the U.S. Forest Service, who discussed the usefulness of small airfields in forest areas to the Service's work of combating forest fires. Members of the Section went to Bozeman on May 2 for a joint meeting with the Montana State College Student Chapter. The group was conducted about the laboratories, where an engineering open house was being held that week for the benefit of visiting high school seniors. During the meeting that followed, the Section's prize of Junior membership in the Society was awarded to Eugene R. Wilde, of the Montana State College Chapter.

NEW MEXICO

MANY ENGINEERING PROBLEMS were involved in the construction of the Alamogordo site for the atomic bomb test, according to Samuel Davalos, former Army major, who was connected with the Manhattan Project. Speaking at a recent meeting of the Section, Mr. Davalos described the considerations that had to be taken into account in selecting a site for the test and other engineering features of the project. At the same meeting, C. U. Forest, former Army captain, discussed the effects of the atomic bomb blasts at Hiroshima and Nagasaki. ASCE Western Representative Walter E. Jessup attended another meeting, which was held

as part of the annual All Engineers Conference, and spoke on the two proposed constitutional amendments.

NORTHEASTERN

PLANS FOR THE extension of the Metropolitan District works were outlined by Karl R. Kennison, chief engineer for the Metropolitan District Water Supply Commission, at a recent joint meeting with the Boston Society of Civil Engineers and the Northeastern University Student Chapter. Mr. Kennison also gave a résumé of past accomplishments of the District, supplementing his talk with slides.

NORTHWESTERN

ADDRESSING THE MAY MEETING on the subject of "Increasing the Capacity and Security of the Panama Canal," Hibbert M. Hill reviewed the history of construction in the Canal Zone—from the operations of the French to the present engineering investigations being made to determine the best means of improving the Canal. Now hydraulic engineer for the Northern States Power Co., Minneapolis, Mr. Hill was in the Canal Zone during the war while serving as a colonel in the Army Corps of Engineers. A special feature of the meeting was the presentation of Section prizes of civil engineering handbooks to Student Chapter members. Winners at the University of Minnesota are: Norman R. Ziemke, first prize; Archie H. Johnson, second prize; and Quentin C. Eyberg, third prize. Recipients at the other institutions in the District are: Leo R. Martin, University of North Dakota; Ernest Buckley, South Dakota State College; James O. Kyser, North Dakota State Agricultural College; and James R. England, South Dakota School of Mines. A large Student Chapter attendance contributed to the total of 167.

OKLAHOMA

FOLLOWING A CANVASS by letter ballot, the Section took action at its second meeting of the year—held in Tulsa on May 2—to divide itself into two branches, to be called the Oklahoma City Branch and the Tulsa Branch. There was considerable discussion of the proposed constitutional amendments, and Joseph W. Keeley read a paper entitled "A New Highway Transition Curve."

NORTH CAROLINA

A DIVERSE PROGRAM of technical and professional talks featured the Section's all-day spring meeting, held in Durham on May 2. Professional matters were covered by ASCE Director William M. Piatt, who reported on the Phoenix meeting, and E. L. Chandler, Eastern Representative of the ASCE, who discussed the proposed amendments to the constitution, stressing the necessity of raising dues to meet increased operating costs. "In the past few years we have become a dynamic force in promoting the professional and economic status of the engineer," Mr. Chandler stated, emphasizing that we are now at the cross roads and must decide whether we are to proceed with a constructive program or drop back to our former role of a purely technical society. The technical program included talks by Stafford R. Webb, chief engineer for the Carolina Steel & Iron Co., Greensboro, who described the structural design for a four-story addition to the Exposition Building in High Point, N.C.; and R. E. Stiemke, associate professor of sanitary engineering at North Carolina State College, whose subject was "Trends in Stream Sanitation."

OREGON

ASCE PAST-PRESIDENT J. C. Stevens attended the April meeting and led a discussion of the proposed constitutional amendments. The technical program for the occasion consisted of a talk by R. H. Baldock, state highway engineer, who spoke on the state highway system, emphasizing the relationship between the development of an adequate highway system and the problem of financing such a program.

PHILADELPHIA

AN ALL-Junior program constituted a highly successful innovation at the May 13 meeting. Scheduled speakers were: Paul Seiler, structural engineer for Modjeski & Masters, Harrisburg, who discussed aircraft structures; Robert Diskant, structural designer for the American Viscose Co., Philadelphia, whose subject was "Torsion and Bending in Asymetrical Built-up I-Beams"; and Bernard Meltzer, who spoke on the registration of professional engineers. The program was arranged by the Section's Committee on Juniors, of which Robert W. Richards is chairman.

PROVIDENCE

NEW ENGLAND IS the stronghold of America's industrialization, according to Antoine Gazda, inventor and manufacturer of the Oerlikon anti-aircraft cannon. Addressing a joint meeting of the Section and the Rhode Island Society of Professional Engineers, which took place in Providence on April 14, Mr. Gazda described in particular New England's role in the manufacture of the cannon. Although this industry was begun as late as 1939, it developed into one of the most important in the war, he stated. Mr. Gazda is adviser to the government on armament research.

ST. LOUIS

A GOOD EXAMPLE of how our country can exercise world leadership is being furnished in Saudi Arabia, where American oil companies have embarked on a huge and mutually profitable program of modernization, Leif J. Sverdrup, St. Louis consultant, told members of the Section at the April luncheon meeting. In a talk on "Oil and Engineering in the Near East," Mr. Sverdrup stated that several irrigation projects are already under way in that country and that a wide variety of public improvements, including power, water, and sewer systems, is planned. The overall program will call for an outlay of almost half a billion dollars, he said. Mr. Sverdrup recently returned from Saudi Arabia and will go there again sometime this summer for his firm, Sverdrup & Parcel, which has construction contracts in that country. A feature of the occasion was the presentation of Section awards of Junior membership in the Society to Harry R. Dreiling, of Washington University, and Carl J. Hunt, of the University of Missouri.

SAN FRANCISCO

ENGINEERING IN Latin America was reviewed by Prof. Harold B. Gotaas, of the University of California, at a recent meeting. Professor Gotaas has been president of the Institute of Inter-American Affairs, and recently received a government citation for his work in developing health and sanitation programs in the Latin-American republics. The rest of the program consisted of short talks by R. P. A. Johnson, of the Forest Products Laboratory, Madison, Wis., and Y. H. Djang, who is in this country as a member of the Chinese Water Conservancy Mission.

SEATTLE

PAPERS PRESENTED BY members of the University of Washington Student Chapter constituted the program at the April joint meeting with the Chapter. First prize of $10 went to Richard Hadley for his paper on "An All-Weather Highway Through the Cascades," and second prize of $5 to Arthur Owley, whose subject was "Effect of Shale on Concrete." William S. Bunch, president of the Chapter, was in charge of the meeting.

SYRACUSE

GUEST OF HONOR and principal speaker at a recent meeting was ASCE Executive Secretary William N. Carey. Discussing the proposed constitutional amendments, the speaker emphasized the necessity of increasing ASCE dues if the Society is to continue to function for the best professional interests of its members.

WEST VIRGINIA

AN INSPECTION TRIP to the Libbey-Owens-Ford Sheet Glass Plant, located in Kanawha City, featured a recent meeting. C. A. Walworth, chief chemist for the organization, conducted the group about the plant and explained the various technical problems connected with the manufacture of sheet and plate glass by the continuous process. A dinner in Charleston followed the trip. Principal speaker at the evening session was R. J. McCall, engineer for the Division of Sanitary Engineering, West Virginia State Department of Health, who described the water pollution in the state and the corrective measures being taken.

MEMBERS OF UNIVERSITY OF PITTSBURGH CHAPTER POSE FOR PHOTOGRAPH Left to right (front row) are: Henshaw, Certo, Decima, Cassell, Bertaccini, Lorenzi, Critchfield. Second row: Spinner, Sumpter, Weinel, Rosenthal, Rees, Omer, Smith. Third row: Oldham, Hertrick, Grecco, Patrick, Eckroth, Professor Ackenheil. Fourth row: Graysas, Marshall, Wilstein, Shroads, Kroen, Louie. Fifth row: Miskevics, Landau, Merchant.

STUDENT CHAPTER *Notes*

IOWA STATE COLLEGE

ONE OF THE first women to be honored by a Local Section with an award of Junior membership in the Society is Miss Mary Krumboltz, of the Iowa State College Student Chapter, who recently received the Iowa Section's Junior membership award. Interested in journalism as well as engineering, Miss Krumboltz has been on the staff of the *Iowa Engineer*, student engineering publication, since entering college, and was its editor in her junior year.

HONORED AS "OUTSTANDING civil engineering senior" at Iowa State College, Miss Mary Krumboltz is recipient of Iowa Section's current award of Junior membership in ASCE. Miss Krumboltz was author of prize-winning thesis on welding continuous railroad rails.

LEHIGH UNIVERSITY

WATER CONSERVATION WAS discussed by ASCE Director Howard T. Critchlow at a recent meeting of the Lehigh University Student Chapter. There was a large turnout to hear Mr. Critchlow, who is chief engineer of the New Jersey State Water Policy Commission. The Chapter now has an enrollment of about 60.

UNIVERSITY OF MARYLAND

A FIELD TRIP TO view construction progress made on the South Capitol Street Bridge over the Anacostia River in Washington initiated the Chapter's spring program. The 47 members making the trip were shown around by A. B. Greene, chief engineer for the Bridge Division of the District of Columbia, and Inspector K. W. Simpson, a recent graduate of the University of Maryland and former treasurer of the Chapter. A film showing the construction of the bridge foundations was scheduled for the next meeting. The second field trip of the season took 60 members of the Chapter to the Sparrow's Point steel mill of the Bethlehem Steel Co. for an all-day inspection of the pipe mill and plate and tin rolling mills. In the evening the group attended the regular monthly dinner meeting of the Maryland Section in Baltimore.

SEVEN WINNERS IN LOCAL SECTION COMPETITIONS TO SELECT entrants for speaking contest at Spring Meeting regional student conference, photographed in Phoenix. Seated, left to right: Elvis L. Bearden, University of Texas; William L. Sparks, University of Arizona; and Kenneth E. Greene, University of California. Standing, left to right: Wilbur W. Squire, University of Colorado; Eugene M. Zwoyer, University of New Mexico; Warren D. Curtis, University of Utah; and Irving I. Sulmeyar, California Institute of Technology. Mr. Curtis won first prize, and Mr. Sparks second.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

1947 Construction Volume Is Less Than Early Estimates

AUTHORITATIVE SOURCES AGREE that there is a temporary lull in construction activity caused by high costs of labor and materials. Although the construction volume predicted for 1947 may not be reached, the tremendous pent-up demand, particularly in the building industry, cannot be delayed indefinitely. A combination of lower construction costs and acceptance of an economy based on a new and higher level of wages and prices will eventually break the present log jam.

According to a Department of Commerce report, construction activity in the first quarter of 1947 totaled 2.3 billion dollars, more than 45 percent above the corresponding quarter of 1946. The report states further that, "It is clear that construction this year got off to a much better start than it did a year ago, but in comparison with the level of activity in the last half of 1946 the first quarter figures showed a marked drop.

"The highest point reached in the postwar resurgence of construction was in October 1946 when the value of work put-in-place reached 1,053 million dollars. From this point activity declined steadily to a figure of only 734 million dollars in February 1947. In March it again turned upward to reach a total of 785 million dollars. The 2.3 billion-dollar figure for the first quarter as a whole compares with a total of 3.1 billion in the third quarter of 1946 and of 2.9 billion in the fourth quarter.

"Most of the drop disappears, however, when allowance is made for the usual seasonal movements. On a seasonally adjusted basis the low point was reached in January, but this point was only 4 percent below the October 1946 peak and the subsequent recovery came to within 1 percent of the October high. For the first quarter of 1947 the seasonally adjusted figures were only about 1 percent under the seasonally adjusted total for the fourth quarter of 1946, the highest quarter of the year.

"Although the value of construction put-in-place during the first quarter of 1947 was close to the level reached in the preceding quarter after seasonal adjustment, it is substantially below the level anticipated in the Construction Division estimate made last December. For all new construction the actual value of work put-in-place during the first quarter was almost 13 percent below that originally anticipated.

"The more important gaps between the earlier estimates and actual performance appear in private residential construction (excluding farm) with a deficit of 20 percent; in private non-residential building, 7 percent; and in highway construction, 26 percent."

New Highway Legislation Awaits Congressional Action

Bills to Extend Federal-Aid Authorizations One Year

COMPANION BILLS in the U.S. Senate and House have been submitted by Senator Lister Hill of Alabama and by Representative Paul Cunningham of Iowa, to extend by one year the authorizations under the 1944 Federal-Aid Highway Act, which provided $500,000,000 annually for three years.

At this writing, approximately $115,000,000 of the first year's total authorization of $500,000,000 is not covered by project agreement and would expire if still uncovered by June 30, 1947, unless Congress approves the year's extension beginning on that date, as provided in these two bills.

Highway officials point out that the delay in the construction program, due to materials shortages, high construction costs and other causes, has been greater in some states than in others. Should the first year's authorization expire in June, they say, distribution of federal-aid funds among the states would be inequable.

The extension would apply to each year's apportionment and would permit the states to complete project agreements with the Public Roads Administration, thus taking up their apportionments in full.

Increased Administrative Allowance Proposed

Legislation introduced by Representative Cunningham would permit the Federal Works Administrator to spend up to $3^3/_4$ percent of authorized highway-aid funds for administration of the act and for highway research and special studies. This bill would amend the Federal Highway Act of 1921, which set a limit for such administrative spending at $2^1/_2$ percent.

Contractual Procedure is Challenged

In another bill before Congress, the federal-aid procedure in effect since 1916, under which contracts are made between the federal and state governments on the basis of authorizations, without waiting for the appropriation of funds, has been challenged.

Representative Richard B. Wigglesworth, of Massachusetts, proposes to wipe out this contractural procedure, limiting federal-state agreements to funds already appropriated. Highway authorities say that such action would make long-range highway programming impossible, reducing federal aid to a year-by-year operation, with no opportunity for advance planning of projects.

Proposed Bill Would Set Up New Agency

Still another bill, presented by Senator Tom Stewart of Tennessee, would authorize the expenditure of $1,125,000,000 in three years for local rural roads. The present law provides $150,000,000 annually for farm-to-market roads, with federal dollars matched 50–50 by the states. The Stewart bill would set up a new agency separate from the Public Roads Administration to administer the program. The federal government would pay up to 75 percent of the cost, the remainder to be borne by the state or local authority.

Cheaper Building Predicted by Producers' Council Head

FIVE FACTORS ARE OPERATING to reduce the cost of constructing homes and other buildings in the immediate future, Tyler S. Rogers, president of the Producers' Council, stated in an address before the annual convention of the American Institute of Architects in Grand Rapids, Mich. Mr. Rogers enumerated these factors, as follows:

"First, a steadily increasing supply of materials is eliminating costly delays in construction.

"Second, competition is becoming keener in every branch of the industry.

"Third, the entire industry is regaining its prewar efficiency in the production, distribution, and on-site assembly of materials and equipment.

"Fourth, the productivity of labor is increasing gradually throughout the industry and further improvement can be expected as time passes.

"Fifth, improved building materials and cost-reducing building techniques are coming into wider use.

"In addition to these forces working to bring about an immediate reduction in costs, the industry is working effectively on a longer-range program to effect economies through research designed to develop savings in the assembly of buildings, the standardization of dimensions of materials, improved engineering of housing and other structures, research in the use of materials in combination, building-code modernization, and the training of industry employees."

Highway Field Needs More Trained Engineers for Nation's Postwar Construction Program

UNLESS NEW ENGINEERS are attracted to the highway field, the nation's postwar construction program will be retarded and normal improvement in technical development will be restricted. This will result in loss in value of the finished product and loss to the taxpayer, Charles M. Upham, chairman of the ASCE Highway Division's Executive committee and engineer-director of the American Road Builders' Association, told the first annual Florida Highway Conference at the University of Florida, Gainesville, Fla., on May 13.

Highway transport in the United States or any other country can only be as efficient as the engineers who are responsible for its development, he declared, and continued:

"Since a state highway department is charged with the responsibility of spending large sums of the public's tax money, salaries for engineers should be commensurate with this responsibility. Low salaries will not attract ambitious young engineers to the highway field and without these engineers, millions of dollars can be wasted. Salaries in industry are carefully adjusted to the amount of responsibility carried by the individual. Losses caused by mismanagement are avoided by fixing salaries that obtain maximum efficiency. Many engineers, returning from war, have been attracted by these salaries and have not returned to their old jobs with the highways."

Mr. Upham pointed out that this country had an estimated $30 billion invested in highways. Its prewar construction program approximated $1 billion annually, with an additional $600 to $700 million spent on maintenance. The expenditure for 1947 will approximate $1½ billion, he said, and predicted that by 1948 or 1949 spending would reach $2 billion a year.

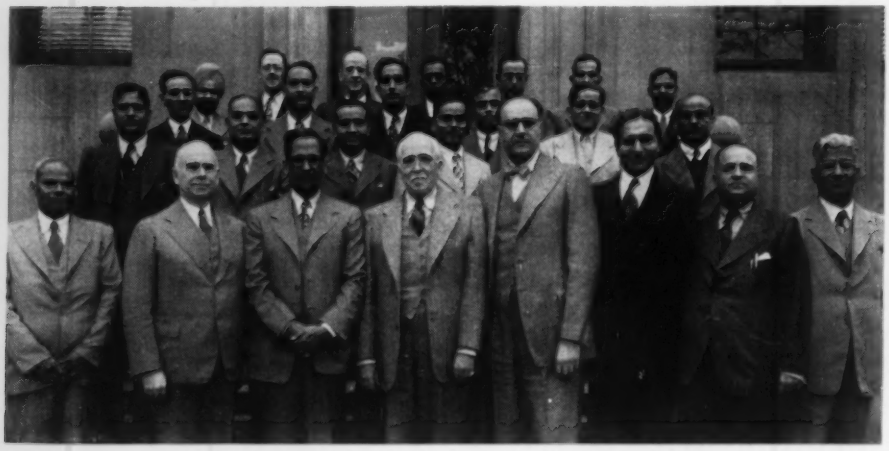
"A program of this size will need a much larger staff of trained engineers," Mr. Upham said. "The need is imperative and can only be met by providing greater incentive to young engineers through increased remuneration and improved educational facilities."

While 1946 had a comparatively small road-building program, 90 percent of the state highway departments have reported that their operations were hampered by lack of trained personnel, the speaker disclosed. A large percentage of the states also reported that their salary scale was insufficient to attract engineering talent. "This condition will become worse as the program increases unless provision is made for providing more trained engineers," Mr. Upham warned.

Reference was made to the wide discrepancy between rates currently paid in many state highway organizations and the salary schedule recommended by the ASCE in October 1946 (CIVIL ENGINEERING for November 1946, page 510).

"Engineering colleges know where their graduates go. Records show that the trend is away from highways into other engineering fields. The chief cause is better pay elsewhere. Engineers who have spent four years, and often more, in college getting a technical education must often accept minor positions at the start, and find that operating machines pays more money than some lower engineering jobs. Conditions like this cause young engineers to turn to railroading and other engineering fields," the ARBA executive said.

Mr. Upham also disclosed that close cooperation is maintained between college teachers of highway engineering and the American Road Builders Association in an endeavor to make highway engineering attractive to students. He strongly advocated that states make available short courses in highway engineering at state colleges and other educational institutions to teach the principles of this profession. A three-month course in highway engineering would serve as a refresher for those with war and prewar education and experience, and at the same time as basic training for beginners, he contended.



ENGINEERS FROM INDIA, on four-month study tour of highway construction under sponsorship of Education Department of Indian Embassy, are greeted in Washington, D.C., by Thomas H. MacDonald, Hon. M. ASCE, Commissioner of Public Roads Administration (front row, second from left) and by Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator (front row, fourth from left).

More City Planning Needed, Fleming Warns Conference

CITIES MUST PLAN or perish, Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator, told the Citizens' Conference on Planning on April 29 in Milwaukee, Wis. Past failures to plan, he warned, have brought more than one city to the verge of bankruptcy.

"We allowed our cities to grow up haphazardly," he said, "and now find that it will cost us untold millions of dollars to make them over into decent and healthful places in which to live."

Congress first gave official recognition to the philosophy of city planning, General Fleming said, when it wrote into the War Mobilization and Reconversion Act of 1944 a title which authorizes the Federal Works Administrator to make repayable advances to assist states and their political subdivisions in the detailed planning of their public works. He emphasized that the law requires that projects planned under this program shall conform to overall municipal, regional or state master plans when these exist. He estimated that the $65,000,000 appropriated for the planning program, which he has entrusted to the Federal Works Agency's Bureau of Community Facilities, will finance the preparation of plans for projects with a construction cost of a little more than $2,000,000,000.

"I reget to say," General Fleming added, "that our authority to assist in the planning of these badly needed local public works, unless extended by Congress, will expire on June 30. I regret also that no provision has been made for replenishing the public works reserve as projects are completed, and that no measures have been devised for the timing of the construction to coincide with other efforts to maintain production and employment at a high level."

The Federal-Aid Highway Act of 1944, administered by the FWA's Public Roads Administration, General Fleming pointed out, earmarks $225,000,000 of an authorized yearly expenditure of $500,000,000 of federal funds during each of three years, for work on the federal-aid system in urban areas. This, he said, "is a wholly new departure in highway legislation." By means of expressways through cities, and circumferential expressways around them for the benefit of traffic wishing to go to residential rather than business districts, this highway program will help in the solution of redevelopment problems which cities now face.

Nine-Day Outdoor Road Show Scheduled for 1948

IN ANNOUNCING the first outdoor summer show, for Soldier Field, Chicago, July 16–24, 1948, J. T. Callaway, ARBA president, states that for the first time in the long series of Road Shows the construction equipment manufacturers will have unlimited outside space for proper display of their machines. Exhibits requiring cover will be amply taken care of in spacious enclosed exhibition halls.

Experimental Hydraulic Studies Undertaken at Proposed $275,000,000 Dam in India

ON HIS TRIP to the Far East, as consulting engineer to the Indian Government, Dr. Lorenz G. Straub, M. ASCE, director of St. Anthony Falls Hydraulic Laboratory, University of Minnesota, reports progress in working out a plan for conducting experimental hydraulic studies at a new waterways experiment station being developed by the Madras Provincial Government. The project to be studied is the Ramapadasager reservoir and irrigation development about 300 miles north of Madras—no ordinary undertaking even judged by the American concept of greatness, according to Dr. Straub.

The dam itself will be the second largest in the world, far exceeding anything heretofore constructed in the British Empire. It will provide two-crop irrigation for over 1,000,000 acres of fertile land, now barren for lack of water, and one-crop irrigation for another 1,000,000 acres. In addition, considerable hydroelectric power will be developed—more than is needed to supply the combined needs of Minneapolis and St. Paul.

Many unprecedented difficulties are anticipated in the construction of the proposed 8,000,000-cu yd concrete dam. These difficulties will be aggravated by the great flood flows of the Godavari River in the early fall of each year, which equal the summer floods on the lower Mississippi. Two difficulties, in particular, will be encountered: (1) The foundation of the dam over much of its length will be more than 200 ft below the stream bed so that over 20,000,000 cu yd of earth excavation will be required; (2) enormous quantities of water will have to be pumped while the dam is under construction. The river diversion problem is therefore most difficult during the long construction period. It is this phase of the project with which Dr. Straub is most concerned.

The cost of the Ramapadasager project, including the dam, irrigation canals and power plant, is estimated at 850 million rupees or about 275 million dollars. The annual value of the crop and hydro-power made available by the project is 100 million dollars.

The first stage of Dr. Straub's work, that of inspecting the dam site, making a boat on the jungle-bordered lower reaches of the Godavari River and reviewing the hydrologic data available, has been completed. His next assignment is that of preparing a technical report making recommendations with particular reference to hydraulic model studies. Some preliminary work in this respect has already been done, beyond which it will be necessary to establish certain routines of procedure. A program will be worked out that will permit dividing collaborative studies between India and the University of Minnesota under Dr. Straub's direction.

Foreign Countries Have Huge Construction Backlog

LACK OF DOLLAR CREDITS in the United States is creating a substantial backlog of industrial construction in foreign countries, O. F. Sieder, executive vice-president and general manager of The H. K. Ferguson Co., industrial engineers and builders, disclosed recently. According to Mr. Sieder, his company has prepared estimates for proposed industrial expansions on every continent, but few projects are going ahead because of the inability of clients to pay for services and American-purchased equipment with dollars.

"Our Export Division has been asked to submit so many estimates for plants in foreign countries," Mr. Sieder said, "that we have been forced to eliminate a large portion of our prospects by asking if the client will be able to draw on dollar credits to pay for the work."

"In relatively few instances," he continued, "do we find that foreign industrialists have capital available in this country. And at the present time, we are not interested in accepting foreign currencies for our services—an outlook shared with most equipment vendors with whom we do business. The International Bank will probably help alleviate this condition when it goes into operation."

The most desirable type of engineering and building in foreign countries in the present market is that which involves the construction of plants for American firms. With few exceptions, however, American firms operating in foreign countries have taken an extremely cautious attitude concerning additional foreign investment. It may be five years before they will feel sufficiently secure to go ahead with foreign construction, according to Mr. Sieder.

One effect of the present bottleneck in foreign industrial construction is that of helping to stabilize demand for specialized engineering talent when there is a letdown in the current boom. This will affect trained engineering personnel in the main, since foreign-built plants are usually constructed with native labor and a minimum number of American supervisory personnel.

NON-HOUSING CONSTRUCTION IS $797,378,000 IN 16 WEEKS

Non-housing construction approved during the 16-week period from January 10 through May 1, 1947, amounted to $797,378,000, a weekly average of $49,836,000, it was announced recently by the Office of the Housing Expeditor. This was slightly below the weekly permissible average of $50,000,000 established on January 10. Denials during the same period totaled $406,137,000, a weekly average of $25,384,000.

Public Health Service Needs Sanitary Engineers

COMPETITIVE EXAMINATIONS for appointments in the Regular Corps of the U.S. Public Health Service in grades of Assistant Sanitary Engineer (1st lieutenant) and Senior Assistant Sanitary Engineer (captain) will be held during June. Approximately ten appointments are to be made.

A Regular Corps appointment is permanent in nature and it provides an opportunity for a qualified sanitary engineer to make a life career of sanitary engineering (including research) as it relates to the protection and promotion of the public health. Assignments to duty are made with consideration of the officer's abilities and experience.

Entrance pay for the Assistant grade with dependents is $3,811 a year and for the Senior Assistant grade with dependents $4,351 a year. Promotions are at regular intervals up to and including the grade of Sanitary Engineer Director which corresponds to full colonel at $8,551 a year. Retirement pay at 64 is $4,950 a year. Full medical care, including disability retirement at three-fourths base pay, and 30 days annual leave with pay are provided.

Each applicant will receive a physical examination by a medical officer of the Public Health Service, an oral academic and professional examination, and a written examination.

Application forms and additional information may be obtained from the Surgeon General, U.S. Public Health Service, Washington 25, D.C. Applications should be submitted without delay.

New Building Materials Tested by National Housing Agency

HUNDREDS OF TESTS and analyses of new types of building materials, houses and construction systems have been sponsored by the Technical Office of the National Housing Agency and the Office of the Housing Expediter to bring economy and efficiency to residential building. The tests range from the nail-holding ability of new materials to the evaluation of heating, condensation and livability characteristics of complete houses.

"The technical data obtained from this testing and development work is made available to the housing industry as rapidly as possible and many housing developers have thus been aided in producing better houses," William V. Reed, director of the office, stated.

"The testing work already done, and the other development products when completed, will add substantially to knowledge of construction techniques applicable to reducing costs of both conventionally built and prefabricated housing. Of course not all new materials that have come in to us have met required standards, but tests in many cases have indicated the direction further development should take. As a result, many of the tested materials are now making a sizable contribution to the home building industry—or will in the near future," he added.

R. Robinson Rowe, M. ASCE

"YOU SHOULD have been at Phoenix," reported Professor Neare. "We learned more about atomic energy from an erudite liar and screwball midget named Cornelius than was hidden between the lines of the Smyth report. I ran into Al E Dayde, too, and he showed me the Alack, Black and Clack tracts he had just surveyed. Since there are irrigation ditches along all lot lines in Phoenix, he had to set buoys for the corner monuments. Figuring the tract size wasn't hard after all, so I trust Joe has the answer."

"It was the problem I've been waiting for," admitted Joe Kerr. "Reduced to algebra, we must make xy a maximum with $x < y < z$ in the equation:

$$xy + xz + yz = 43{,}560$$

"Except that the solution must be in integers, we could make $x = y = z = 120.5$, so it is likely that y is 120 or 121. So I added y^2 to each side and factored like this:

$$(x + y)(y + z) = 43{,}560 + y^2$$

to make $x + y$ nearly equal to $y + z$. Trying $y = 121$, the best factors were 143×407, making $xy = 2{,}662$. But $y = 120$ yields the factors 230×252 and my answer, $xy = 13{,}200$ sq ft."

"That's pretty good for Joe," said Cal Klater patronizingly. "It's a pretty answer, because the lots are 110×120, 110×132 and 120×132 with areas in the ratios 10:11:12. But I can give Clack

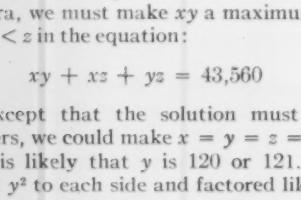


Fig. 1. The shape of an acre.

enuf room for a 2-car garage. I let the 3 dimensions be $x - a$, x, and $x + b$, where x, a and b are positive integers, x is near 120 and a and b are small. Then Clack's area is:

$$A = x(x - a) = 14{,}520 - \frac{1}{3}(2bx + ax - ab)$$

Since ab is very small, maximum A depends on minimum $x(2b + a)$, so we should expect b to be less than a. Solving for x in

$$x(x - a) + x(x + b) + (x - a)(x + b) = 43{,}560$$

$$x = \frac{1}{3}(a - b + \sqrt{a^2 + ab + b^2 + 130{,}680})$$

Since the quantity under the radical must be a square, and probably the next square larger than 130,680 in order to make a and b small, set

$$a^2 + ab + b^2 = 364$$

$$a = \frac{1}{2}(-b + \sqrt{1{,}456 - 3b^2})$$

Then the smallest b making a rational is $b = 2$, whence $a = 18$, $x = 126$ and Clack's tract is $108 \times 126 = 13{,}608$ sq ft."

"Bright you are," exclaimed the Professor, "and for some who insist that the width of a lot is its frontage, here's a sketch to satisfy them. Then I'm going to dodge any argument by introducing one of our Life Members as Guest Professor Eepe."

"Several years ago," responded Professor Eepe, "my old friend Otto Drinkwater was told by his physician to cut his 4-finger nightcaps down to 2 fingers. Otto did but Otto was a sly one. He always drank from a conical toddy glass 4 in. high by 3 in. in diameter at top and 2 in. at bottom, and his fingers averaged $^3/_4$ in. wide. He tipped the glass so that when he measured 2 fingers on the high side, the low side was full to the lip, claiming that he doubled his 2-finger dose to his 4-finger custom. What do you think?"

[*The Cal Klaters were Harold J. Welch, Robert W Woodbury and E P Goodrich, the latter also being Guest Professor Eepe. Also acknowledged is a correct solution of the Friscoak Bridge problem from R E Philleo, delayed by the forwarding process.*]

Action and Reaction Present Numerous Knotty Problems

ANY ENGINEER who has had no trouble with action and reaction, keeping each in its proper place and not using the wrong one in his analysis, is wasting his time reading these paragraphs. They are being written to end once and for all the confusion that arises from the similarity, and also the difference, between these two forces. Action and reaction are both equal and opposite. Even in the simple case of a rope being stretched it is often very difficult to tell whether it is the action or the reaction that breaks the rope.

Consider the case of a 200-lb weight hung by means of a $^3/_4$-in. rope. The force in the rope is clearly 200 lb. This can be verified by inserting a spring scale in the rope. Since the area of the rope is 0.045 sq in. the stress is 200/0.045 psi. If, however, a pull of 200 lb is exerted on the upper end of the rope in an attempt to lift the weight, the force in the rope is 400 lb (200 lb at each end) and the stress is 8,889 psi; and this is too high for safety if the rope is of Manila and a bit old. Here as a check, two 200-lb scales should be inserted, so as to record accurately the tension in the rope. These scales can be hooked in tandem at the center of the rope for convenience in obtaining simultaneous readings. Even the casual observer will quickly see that each scale reads 200 lb, which, when added together to get the total force in the rope, checks the 400-lb figure used in the calculations above.

If, however, the rope is laid horizontally parallel to a meridian (any meridian) and subjected to a pull of 100 lb at each end, the stress is clearly a tension of 200 lb in the north-south direction as viewed from the west. Viewed from the east the problem is entirely different. The stress is in a south-north direction and therefore has a sign opposite to that already found. The rope is clearly in compression. This is very reasonable since the solution of any problem depends upon the point of view. We have here an over-simplification of the difference between the Occident and Orient, in their views of national problems.

Again, if a rope has a 100-lb pull at each end and the two ends are tied together, the tension in the rope will double and redouble until something happens. To prove this experimentally requires a high degree of skill. Not only must one take care not to bend the rope when joining the ends and tying the knot (thus changing the direction of the stress) but he must also make sure that the knot does not slip or results of the experiment will be valueless and inconclusive.

The case of reversal of stresses (compression on one end and tension on the other end of a rod) is very interesting but seldom fully treated by writers on the subject. It occurs often in practice, as in the case of reinforcing bars in a continuous concrete beam over several supports where there may be tension on one end of a section which varies to compression on the other. This problem can be solved by welding the two ends of the bar together while stressed. No further trouble will be experienced with that bar. I have never seen this done but feel sure it will work, theoretically, if practical difficulties can be overcome.

It is well known that a pulley is used to change the direction of the forces in a rope. This is of great advantage in doing the famous "Indian Rope Trick." If the fakir weighs, say 95 lb, all he has to do is to compress the rope 100 lb (by exerting a 50 lb force on each end) then, by means of a cleverly concealed pulley, change the direction of this compression to tension and climb up the rope, to the astonishment of those tourists who are not subscribers to this valued publication and readers of this learned article.

If any one has a clearer presentation of the relationship between action and reaction it is no more than his duty to send it in for the consideration of our readers and the advancement of the profession.

"Though old the thought and oft expressed
"Tis his at last who says it best.
"I'll try my fortune with the rest."

LXXX Anne

Wool Gatherings by WOOLLEY

PLANS ARE BEING PREPARED for construction of "The Golden Eagle" bridge across the Mississippi River a few miles north of St. Louis, Mo.

DENVER, COLO., has a $30,000,000 expansion and improvement program for its city water system.

THE BUREAU OF RECLAMATION has a 6-year program of power-plant and transmission-line construction in the Missouri Basin and other areas involving a total outlay of over $800,000,000.

A SURVEY OF ENGINEERING SCHOOLS in the United States and Canada indicates that over 14% of the students are taking Civil Engineering.

SO FAR only 1/10 of 1% of the energy contained in uranium atoms has been utilized.

SOME 238 WATER AND POWER PROJECTS in the Columbia River Basin are included in a plan prepared by the Bureau of Reclamation.

THE MAYOR OF SAN FRANCISCO has recommended a bond issue of more than $57,000,000 to finance comprehensive plans for untangling the city's growing traffic snarl.

THE HOTTEST FLAME known to man is one in which hydrogen burns in fluorine. This union produces temperatures of over 6,000 deg.

CROPS GROWN on reclamation lands last year were worth $500,000,000.

IN ENGLAND, strikes are prohibited among gas, electricity or water utility employees where such a strike would deprive a community of these services.

THE UNITED STATES, through loans, lend-lease, surplus supplies and relief, in the last two years has spent, or pledged itself to spend over $15,000,000,000 in support of civilians in foreign countries.

TODAY CANCER KILLS one person every 3 minutes.

ESTIMATED AUTO PRODUCTION this year is 5,500,000 passenger cars and trucks.

DEBT IN THE UNITED STATES has risen from $308 per person in 1939 to $1,851 per person at present.

BEST ESTIMATES are that about 825,000 new homes may be begun in 1947.

THE ELVEN-MONTH-OLD STRIKE at Allis-Chalmers cost the workers an estimated $20,000,000 and the employer an estimated $65,000,000.

THE FIRST WATER SUPPLY systems of New Orleans were built in 1793 and consisted of about 6 miles of piping made by boring red cypress logs and joining them end to end.

New Publications

Traffic Engineering. Because of the rapidly rising motor vehicle volume and the resultant increase in accidents and congestion, a revised and expanded edition of *Traffic Engineering and the Police* has been published by the National Conservation Bureau. Co-authored by Henry K. Evans, Assoc. M. ASCE, and Franklin M. Kreml, the 104-page book is designed to assist police departments in solving their growing traffic problems. The book, which sells for $2 a copy, may be obtained from the Association of Casualty & Surety Executives, 60 John Street, New York 7, N.Y.

Steel Products. Two more sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, are now available. These are Section 6, covering "Carbon Steel Plates and Floor Plates," and Section 15, entitled "Hot Rolled Carbon Steel Wire Rods." Copies may be purchased from the American Iron and Steel Institute, 350 Fifth Avenue, New York, N.Y., at a cost of 25 cents each postpaid.

Chicago. A graphic picture of the development of Chicago in the past 14 years is presented in a 372-page, paper-bound volume, entitled *Chicago's Report to the People, 1933–1946*. Of special interest in this story of the administration of Mayor Edward J. Kelly, M. ASCE, are the chapters covering the tremendous engineering projects carried to completion during the period.

Economic Development. The objectives of the Committee for Economic Development (CED)—founded in 1942 by a small group of businessmen in an effort to avert serious postwar unemployment—are outlined in a bulletin entitled *Freedom Has Its Price*. Single copies of CED publications may be obtained without cost from the offices of the organization at 285 Madison Avenue, New York 17, N.Y.

Vertical Displacements. Computation of vertical displacements in elastic foundations is made easier in a recently published bulletin (No. 367) of the Engineering Experiment Station of the University of Illinois. Copies of Bulletin 367 will be mailed free for a limited period, upon application to the Station at the University of Illinois, Urbana, Ill.

Streamlining. To provide an informative manual of the mathematical and graphical factors involved in streamlining, the Georgia Tech Engineering Experiment Station has released a new bulletin—*Streamline Graphics*—by Joseph P. Vidosic, associate professor of engineering drawing and mathematics. Inquiries should be addressed to the Georgia School of Technology, Atlanta, Ga.

Safety Standards. Approximately 200 standards covering safety and industrial health are listed and briefly described in *American Safety Standards*, a recent catalogue of the American Standards Association, 70 East 45th Street, New York 17, N.Y. The complete set of all the American Safety Standards sells for $30.

Water Hammer. The causes and cure of water hammer are outlined in a new six-page booklet, issued by the Wade Manufacturing Co. (makers of drains and plumbing specialties), Elgin, Ill.

Water Resources. A mimeographed review of the water resources of the United States and Canada—issued by the U.S. Geological Survey in cooperation with the Dominion Water and Power Bureau—is available for the six-month period ending March 31, 1947, upon application to the Department of the Interior, Washington, D.C.

Housing. More and better houses can be provided at lower cost by means of prefabrication, large-scale building and site fabrication, according to a bulletin of the Twentieth Century Fund, entitled *Building America's Homes*. The 12-page booklet may be obtained from the Twentieth Century Fund, 330 West 42d Street, New York 18, N.Y., at a cost of 5 cents.

Soil Mechanics. Definitions of soil components—issued as the Report of Committee VII of the Civil Engineering Division of the American Society for Engineering Education—appear in the March 1947 issue of the ASEE's quarterly publication. Inquiries concerning the report should be addressed to the chairman of Committee VII, Prof. Donald M. Burmister, Assoc. M. ASCE, Columbia University, New York 27, N.Y.

LARGEST JAW CRUSHER

MOVABLE JAW of world's largest overhead eccentric jaw crusher, 10 ft 10 in. high and weighing 35,000 lb, has hard-rock capacity of 210 tons per hour at 3-in. discharge opening. Complete crusher stands 11 ft 1/2 in. high and weighs 84,000 lb. Producer is Lippman Engineering Works, Milwaukee, Wis.—for Charles Hoyt, Silverton (Ore.) construction contractor.

Railroads. Answers to many questions that are commonly asked about the American railroads are given in convenient form in *Quiz on Railroads and Railroading*. The sixth edition of this widely quoted booklet is now available without charge upon application to the Association of American Railroads, Transportation Building, Washington, D.C.

Timber Research. Research facilities for the lumber and wood-using industries and other industrial users of wood are described in a new publication of the Timber Engineering Co., an affiliate of the National Lumber Manufacturers' Association. Inquiries are invited by the Director of Research, Timber Engineering Co., 1319 Eighteenth Street, N.W., Washington 6, D.C.

Safety in Machinery. An industrial data sheet, entitled "Concrete Mixers and Pavers," has been issued by the National Safety Council as a feature of its construction-safety program. Reprints may be obtained from the National Safety Council, 20 North Wacker Drive, Chicago 6, Ill. The cost is 30 cents apiece for quantities up to nine; 20 cents apiece for quantities between 10 and 99; and 10 cents each in lots over 100. Members of the National Safety Council receive a 50 percent discount.

Concrete Research. First in a series of reports of extensive researches being sponsored by the Committee on Reinforced Concrete Research of the American Iron and Steel Institute is a paper on "Comparative Bond Efficiency of Deformed Concrete Reinforcing Bars," by Arthur P. Clark, Assoc. M. ASCE. The paper has been issued as part of the December 1946 number of the *Journal of Research of the National Bureau of Standards*.

Industrial Directory. For the first time an Industrial Directory of Mexico is available. To facilitate its use in the United States, a special Spanish-English dictionary has been included in the 1,024 page volume. The Directory sells for $20, and may be obtained from Publicaciones Rolland, S. de R.L., Plaza de la Republica No. 6-407, Mexico D.F.

Marine Borer Research. In the interest of distributing accurate and up-to-date information on harbor conditions, the Port of New York Authority has authorized publication of the 1946 Report of the Marine Borer Research Committee, New York Harbor. Dr. William F. Clapp, who is responsible for the analysis of data and preparation of the report, has an article on marine borer activity in the current issue. The report may be obtained without cost from the Department of Port Development, Port of New York Authority, 111 Eighth Avenue, New York 11, N.Y.

Systematic Development of Airports Is Urged

STEPS TO PRODUCE orderly development of a national system of airports are proposed in a declaration adopted by the Chamber of Commerce of the United States at its annual meeting, April 28–May 1. The need for systematic airport development, the Chamber holds, justifies reasonable federal aid. It also urges that reasonable user charges be required at all publicly-owned airports and that as soon as practicable such airports be put on a self-sustaining basis.

The Chamber's declaration was based on a report of its Transportation Committee. While agreeing that the Federal Airport Act of 1946 lays the basis for federal participation, the committee points out that it has become increasingly evident as the act is being put into effect that there has not been general realization of the magnitude and cost of a nationwide airport system and the limitations on federal funds likely to be available. It recommends closer restriction on the features of airport development for which federal funds may be used.

Northwest Joint Conference Discusses Snow Forecasting

WATER RESOURCES of the North Pacific Region and methods of forecasting seasonal supply by means of snow surveys were the subject of a three-day joint meeting held in Portland, Ore., April 21–23. The three organizations participating were: Columbia River Basin Water Forecast Committee, Western Snow Conference, and the Section of Hydrology, American Geophysical Union. J. C. Stevens, Past-President ASCE, general chairman of the Section of Hydrology, American Geophysical Union, presented a paper on "Developments and Improvements in Hydrologic Instruments."

Other ASCE members who took part in the sessions include: George G. West, secretary, Section of Hydrology, American Geophysical Union; and Charles Bartholet, Merrill Bernard, John Bliss, George H. Canfield, George D. Clyde, George H. Ellis, D. K. Fuhriman, H. D. Hafterson, Clyde E. Houston, Arthur Johnson, J. E. Jones, C. C. McDonald, Fred Paget, R. L. Parshall, Kenneth N. Phillips, Forrest Rhodes, and Fred M. Veatch.

Meetings and Conferences

American Society of Mechanical Engineers. The engineer's responsibility in increasing national productivity will be the general theme of the semi-annual meeting of the American Society of Mechanical Engineers, to be held at the Hotel Stevens in Chicago, June 15–19. A general arrangements committee of Chicago members, headed by J. R. Michel, will be host to members who arrive early at a dinner at the Michigan Shores Club, Wilmette, Sunday evening.

American Society for Testing Materials. More than 150 technical papers and reports by the country's leading authorities in the field of materials are scheduled for presentation at the 50th annual meeting of the American Society for Testing Materials, to be held at the Chalfonte-Haddon Hall Hotel in Atlantic City, June 16–20.

NEW IN Education

INCREASED ECONOMIES in the building of small houses are expected as a result of a grant of $45,000 by the Office of Technical Services of the U.S. Department of Commerce for research at the University of Illinois in methods of erecting industry-engineered housing. The housing on which the research will be conducted has been developed jointly by the Producers' Council and the National Retail Lumber Dealers' Association during the last 18 months. Means of increasing building efficiency will be determined by constructing six identical houses in succession and devising means of eliminating waste motion and effort.

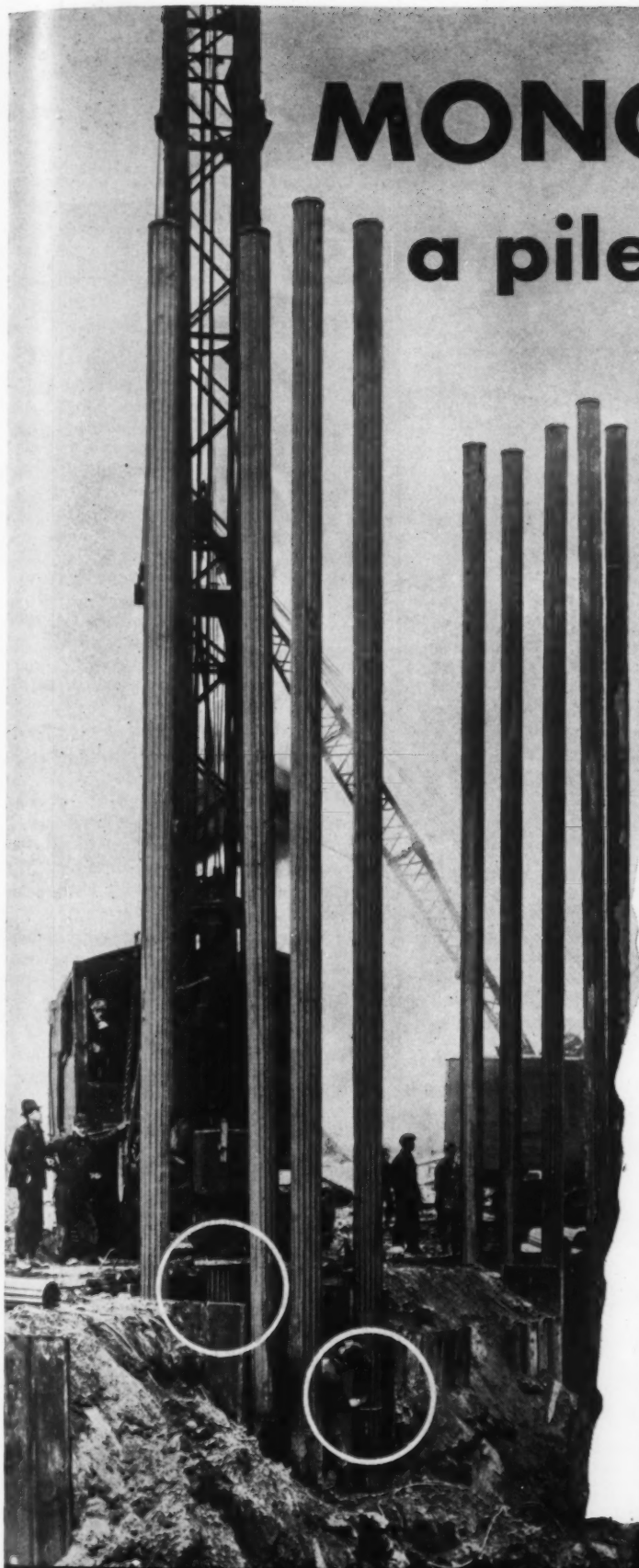
INCO (International Nickel Co., Inc.) is extending its fellowship awards in Canada, Great Britain and the United States. For the past six years post-graduate scholarships have been given to students in three Canadian universities—Queen's, Toronto and McGill. Such cooperation has now been established with educational institutions in Great Britain and the United States which offer courses in mining, metallurgy and engineering. In the United States 6 two-year fellowships will be awarded bi-annually over a period of 12 years.

SEVERAL PIECES OF MODERN equipment have been purchased by the Department of Civil Engineering of Clemson College for use in courses devoted to the study of engineering properties of soils and concrete. The new equipment includes a direct-shear machine, a tri-axial shear machine capable of applying loads in three different directions, California Bearing Ratio test equipment, a Casagrande consolidometer, and sonic testing apparatus for the study of concrete properties—unique in that it does not destroy the specimen.

IN THE FALL of 1947 the John N. Derschug Memorial Scholarship in Engineering will be established at the College of Applied Science of Syracuse University. It is designed to enable young men of potential scientific talent and aptitude to acquire such professional training as will fit them to take positions in which science, engineering, and leadership are of basic importance. The scholarships cover full tuition and expenses for complete courses in engineering given during the regular academic year. Inquiries should be addressed to Dean Louis Mitchell, College of Applied Science, Syracuse University, Syracuse, N.Y.

TWO NEW DEGREES will be given by the School of Engineering of the University of Mississippi in connection with its new comprehensive program. The Bachelor of Science degree in general engineering, composed largely of basic engineering courses, has been changed to a degree in Engineering Administration. In addition, courses leading to the new degree of Bachelor of Science in Geological Engineering will be offered, tying

MONOTUBES...
a pile of strength



THE steel plant foundation job pictured here got off to a good start—with Monotubes, the tapered steel piles that have extra advantages.

These 12″ diameter Monotubes—in 72 to 80-ft. lengths—were furnished in two sections to eliminate use of unusual length leads. Note in circle at left, driving is under way. In circle at right, note how extension has been positioned and fully welded without interfering with driving operations. Time is saved, labor costs reduced.

Monotubes have other advantages that make savings for job-wise builders. Their fluted, tapered construction speeds driving; they are easily extendible to any required length, right on the job; they are light in weight and easy to handle; and, because of tubular design, Monotubes can be thoroughly checked, top to toe, before concreting.

You can depend upon Monotubes for economy and efficiency in constructing buildings, bridges, piers, airports, highways. Available in gauge, size and taper to meet varying soil conditions. For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

UNION METAL

Monotube Foundation Piles

in with the location on the campus of the State Geological Survey and the office of the Groundwaters Division of the U.S. Geological Survey, affiliated with the Department of Geology.

STEVENS INSTITUTE of Technology is building a fourth tank to test the stability of airplane-carrier models in a research program sponsored by the U.S. Navy. The Damage Control Research Laboratory will use the new tank in making ship stability studies for the Office of Naval Research, Special Devices Center, thus expanding the research program described in the March issue of CIVIL ENGINEERING, page 163. The new tank, 40 ft long, 7 ft wide and 4 ft deep, will be housed in a one-story addition to a present building. The tank will be unique in that it will be used to test the static stability of ships under various conditions of loading and flooding which may occur when a ship is damaged. Damage-control research for the U.S. Navy was begun at Stevens more than two years ago, when Kamikaze attacks were causing great damage to American ships in the Pacific, especially to aircraft carriers.

A SYMPOSIUM ON FLUID MECHANICS will feature the advanced engineering courses offered in the University of Michigan's summer session, June 23 to August 16. The symposium will be conducted largely by two visiting teachers, Prof. Hunter Rouse, M. ASCE, director of the Institute of Hydraulic Research, State University of Iowa, and Prof. Sydney Goldstein of the University of Manchester, England. Others participating will include Prof. Boris A. Bakhmeteff, Hon. M. ASCE, of Columbia University; Dr. Hugh L. Dryden, assistant director, National Bureau of Standards; Prof. L. G. Straub, M. ASCE, University of Minnesota; Prof. V. L. Streeter, M. ASCE, Illinois Institute of Technology; Th. Von Karman, M. ASCE, California Institute of Technology; J. E. Warnock, M. ASCE, U.S. Bureau of Reclamation; and, from the civil engineering staff, University of Michigan, Professors R. A. Dodge, M. ASCE, and E. F. Brater, Assoc. M. ASCE. Detailed information may be secured from the Secretary, Summer Session, University of Michigan, Ann Arbor, Mich.

YALE BUREAU OF HIGHWAY TRAFFIC'S first reunion and seminar was attended by 64 alumni from 15 states, the District of Columbia and Canada. The meeting was held in conjunction with the university's annual alumni gathering. Theodore M. Matson, director of the Bureau, reported that 37 percent of a total of 172 alumni attended, including representatives from each of the former classes of the Bureau. Nearly all those attending are employed by state, city and federal agencies; the others are actively engaged in highway traffic work in other fields. Technical seminars covered: State-City Relationships in Traffic; Effective Application of Engineering to Highway Traffic; and Future Developments in the Traffic Field.

GRADUATE WORK in sanitary and public health engineering has been greatly expanded at the University of Missouri in recent years through the establishment of new courses, building of modern laboratories, and enlargement of the library. An undergraduate Sanitary Option in the Civil Engineering Department has been developed and the graduate program has been approved by the U.S. Public Health Service as meeting its standards for training personnel with Social Security funds. The program—under the immediate direction of Prof. Lindon J. Murphy, M. ASCE, and Scott Johnson—benefits from the cooperation of the Missouri State Board of Health and the W. K. Kellogg Foundation of Michigan. For detailed information address Harry A. Curtis, Dean, College of Engineering, University of Missouri, Columbia, Mo.

STUDENT CENTER devoted to undergraduate activities, providing headquarters for student organizations, publications and social affairs, will be part of University Development Plan, long-term program for improvement of scholarly and physical facilities of Columbia University, New York, N.Y. Program is to be realized as gifts from alumni and friends make construction possible. Architects are Shreve, Lamb and Harmon.

NEWS OF Engineers

Samuel Rollo Young has taken over the management of three railroads operating in and out of Atlanta, Ga. He is the new president and general manager of the Atlanta & West Point Railroad Co., and the Western Railway of Alabama, and general manager of the Georgia Railroad. Mr. Young has been connected with the Atlanta & West Point Railroad and the Georgia Railroad since 1916. He was chief engineer for the roads from 1931 to 1944, and since the latter year has been assistant general manager of the three railroads.

Samuel R. Young

Franklin Thomas, director of the Metropolitan Water District of Southern California, will represent the district on the six-member Colorado River Board of California—created to study the problems of the river, particularly as they affect the rights and interests of California. Mr. Thomas is a former Director and Vice-President of the ASCE.

Col. Albert B. Jones, who recently retired from the Army Corps of Engineers after 28 years of service, will be in charge of the new office the Knappen Engineering Co. is opening in Miami, Fla.

George E. Solnar, Jr., is now manager of the Clay Brick Manufacturers' Association, with offices in San Francisco.

James B. Wells, professor of civil engineering at Stanford University, has been elected chairman of the Board of Public Works of the City of Palo Alto, Calif.

Charles L. Wachter and **Jed S. Foster** have organized the New York consulting firm of Foster-Wachter, which will specialize in preparing designs and specifications for cableways and hoisting equipment. Mr. Wachter, who was formerly associated with Mr. Foster in the Lidgerwood Manufacturing Co., holds a number of patents for improvement in speed and efficiency of cableway installations.

S. S. Steinberg, dean of the college of engineering at the University of Maryland, has been elected an honorary member of the Society of Engineers of Colombia. Colombia is one of several South and Central American countries that have similarly honored Dean Steinberg, who made a good will tour of Latin America for the Department of State.

Carl L. Stetson, Jr., is now an assistant civil engineer in the California State Division of Architecture, with headquarters in Sacramento.

Start of flame-cleaning operation on water tower structure

It's Flame Cleaning

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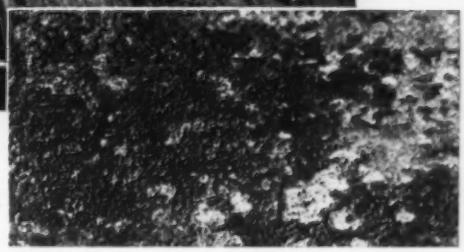

BEFORE — *Close-up view shows conditions of paint-lift heavy rust and scale that were met.*

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QUICKLY, easily and safely applied, the Airco flame cleaning process provides a clean, warm and dry surface conducive to a lasting paint job. The oxyacetylene flame cockles old paint, loosens rust and drives off hidden moisture . . . gives longer paint life to all kinds of steel structures.

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For further details write for folder ADG-1066B—"Flame Cleaning and Dehydrating Old Steel Structures," and folder ADG-1067A—"Flame Cleaning and Dehydrating New Steel Structures." Address: Air Reduction, General Offices: 60 East 42nd Street, New York 17, N.Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas. Represented Internationally by Airco Export Corporation.

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1. Provides a clean, warm and dry surface conducive to a lasting paint job.

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Maj. Gen. Thomas F. Farrell, chief engineer of the New York State Department of Public Works and a veteran of both World Wars, will become the new chairman of the New York City Housing Authority on July 1. Except for a period of wartime service, General Farrell has been chief engineer of the state since 1930. During the war, he supervised the building of the Ledo Road in Burma and served under Maj. Gen. Leslie Groves in developing the atomic bomb.

T. F. Farrell

Harry H. Hawley, associate professor of civil engineering at Ohio State University, has accepted a similar position at Union College, Schenectady, N.Y., and will begin his work there in September. During the war, Professor Hawley served as area engineer on the construction of the Alcan Highway and as Engineer officer of the 1178th Engineer Construction Group, in the South Pacific.

E. N. Hunting, president of the Pittsburgh firm of Hunting, Davis & Dunnells, Inc., announces a change in the firm name to Hunting, Larsen & Dunnells, Inc.

Robert F. Ewald retired on April 1 after 35 years on the engineering staff of the Aluminum Co. of America. Hydraulic engineer in the Pittsburgh office of the company since 1917, Mr. Ewald conducted investigations in connection with the Little Tennessee projects and did notable preliminary work on Fontana Dam.

Harold F. Hammond has resigned as Washington representative of the American Transit Association to become assistant manager of the Transportation and Communication Department of the Chamber of Commerce of the United States. During the war, he served as transportation consultant to the Office of Defense Transportation and the Norfolk, Va., Naval Operating Base.

C. G. Dandrow, vice-president and general sales manager of the Industrial Products Division of the Johns-Manville Corp., was recently inducted into the company's Quarter Century Club, an organization honoring 25 years of active association with the company.

Harry W. Loving, until recently vice-president of the J. A. Jones Construction Co. of Charlotte, N.C., has joined the Southeastern Construction Co., of Charlotte, in a similar capacity. During the war, Mr. Loving was connected with the Office of the Chief of Engineers—first as chairman of the Construction Contract Board and, later, as chief of the Price Adjustment Branch.

Hawley S. Simpson, Philadelphia consultant, has established a partnership with **John F. Curtin,** under the firm name of Simpson & Curtin. The firm will continue to maintain offices in Philadelphia, specializing in transit labor relations, traffic, and other management problems. Mr. Curtin was transportation engineer on the atomic bomb project at Oak Ridge, Tenn., before joining Mr. Simpson's firm in 1945.

Paul F. Keim, principal engineer for the Federal Power Commission, Washington, D.C., is in Liberia, West Africa, as consulting engineer for the Liberian Economic Mission, which is sponsored by the United States government. Mr. Keim was recently released from the Navy Civil Engineer Corps after five years of service.

Daniel J. Brumley, retired chief engineer of the Chicago Terminal Improvements, Illinois Central Railroad, has been awarded honorary membership in the American Railway Engineering Association.

Jens P. Nielsen, previously designing engineer for the Chicago, Burlington & Quincy Railroad, Chicago, Ill., has been promoted to the position of assistant engineer of buildings.

E. B. Debler, director of Region 7 of the Bureau of Reclamation, is retiring after many years of government service. Mr. Debler has been on the staff of the Bureau since 1918—for the past three years as director of the newly established Region 7. Another ASCE member, **Harold D. Comstock,** has retired after more than 40 years with the Bureau. Mr. Comstock's most recent assignment was as director of Region 6.

Edward Braddock has been appointed park engineer for Minneapolis, Minn. He was formerly project planner for the Minneapolis Planning Commission.

J. August Rau, chief engineer of the Allison Steel Manufacturing Co., Phoenix, Ariz., recently received a War Department citation for his wartime service as head of the engineering department of the 40-ton M-3 pneumatic floating bridge. Other ASCE members on the engineering staff of the company are **George E. Wilbur, Walter E. Riley, A. V. McEowen, Franklin J. Foltz,** and **Ralph A. Watson.**

J. AUGUST RAU RECEIVES WAR DEPARTMENT CITATION from Col. Hugh M. Arnold, commander, Yuma Army Engineer Board. Reading left to right: Mr. Rau; George W. Howard, chief civilian engineer of Army Engineers Test Branch at Yuma; and Colonel Arnold.

Charles B. Spencer, New York engineer and contractor, was elected president of the Moles, New York society of tunnel and heavy construction men, at the annual meeting of the organization on May 7. He is vice-president of Spencer, White & Prentis, specialists in underpinning and foundation work. During the war, his firm was engaged in the construction of roads in Persia, airfields in the Bahamas, and huge drydocks for the U.S. Navy yards.

Charles B. Spencer

Newton A. K. Bugbee, civil engineer of Trenton, N.J., was recently awarded an honorary life membership in the Engineers Club of Trenton. One of the organizers of the Club, Mr. Bugbee served as its third president in 1916. He is one of five engineers who have been thus honored by the Club since it was founded.

Herbert Davidson, consulting engineer of Larchmont, N.Y., will command the 149th Composite Group, Organized Reserve, the Bronx. Colonel Davidson holds a number of decorations for his overseas service during the war, including the Bronze Star Medal and the Army Commendation Ribbon. As district engineer with the 14th Air Force in China, he was prominent in the construction of air fields and Air Force facilities.

Edwin A. Thornquist—with **Everett D. Witte** and **Sherman A. Smith**—has formed a partnership for the practice of engineering and architecture, under the firm name of Thornquist, Witte & Smith. Headquarters of the firm will be Burlington, Iowa. Mr. Thornquist was formerly with the Stanley Engineering Co. of Muscatine, Iowa.

James Logan, chief engineer of the Santaniello Construction Co., Jersey City, N.J., has been elected first vice-president of the New Jersey Society of Professional Engineers.

Henry F. Stubbs has opened a consulting office in San Antonio, Tex. In addition to doing consulting work for the petroleum companies, he has been appointed vice-president of the Ambursen Engineering Corp., of New York, with regional office in Houston, Tex. Projects under design in Ambursen's Houston office include the Whitney Dam and powerhouse on the Brazos River for the Army Corps of Engineers. Mr. Stubbs recently returned to the United States from South America, where he was chief civil engineer for the Socony Vacuum Oil Co. of Venezuela and Colombia.

John C. Gist was recently elected vice-president of the contracting firm of A. Teichert & Son, Inc., Sacramento, Calif. Connected with the firm since 1940, Mr. Gist has served as project manager on the construction of a number of war projects, including the Sacramento Signal Depot.

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Henry K. Evans, director of the traffic engineering division of the National Conservation Bureau, was elected president of the New York Section of the Institute of Traffic Engineers at the annual meeting of the group. Mr. Evans is editor of *Traffic Engineering Magazine*, official organ of the Institute, and author of several books and articles on safety and traffic control. His most recent book, *Traffic Engineering and the Police*, is reviewed in the "New Publications" department of this issue.

Henry K. Evans

Ernest R. Brooks has been appointed surveyor and regulator in charge of the Fourth Survey District, in the Philadelphia Bureau of Engineering, Surveys and Zoning.

Frederick R. Storrer recently resigned as city engineer of Dearborn, Mich., after 22 years in the service of the city. He has opened a consulting civil engineering office in Dearborn, and his practice will include city and regional planning.

L. H. Nishkian and his son, **B. L. Nishkian,** have formed a consulting engineering partnership, with headquarters in San Francisco. During the war, Mr. B. L. Nishkian served in the Navy Civil Engineer Corps.

Robert K. Sawyer has been appointed director of the Bureau of Municipal Research, Philadelphia, Pa.

Rex Reed was recently transferred from the Washington, D.C., office of the U.S. Bureau of Reclamation to Amarillo, Tex., where he will be regional planning engineer.

Percy M. Othus has been appointed special assistant to the U.S. District Engineer at Portland, Ore., where he will be in charge of the design and construction of flood control facilities for the Willamette Valley basin. Mr. Othus recently returned from China, where he was on a special assignment as executive engineer for the Yellow River consulting board.

Robert E. Tobin is now district engineer for the Portland Cement Association at Spokane, Wash. Mr. Tobin was previously professor of civil engineering at Gonzaga University, Spokane.

John L. Franzen has resigned as city manager of Oregon City, Ore., to become city manager of Salem, Ore.

Francis J. Laverty, until lately chief of the sewage treatment section in the Bureau of Sewage Disposal, New York City Department of Public Works, has accepted the position of superintendent of public works for Ithaca, N.Y.

Richard B. Dunbar has been made manager of the Fort Worth, Tex., Chapter of the Associated General Contractors of America, with offices in Fort Worth. During the war, Mr. Dunbar served as a colonel in the Army Corps of Engineers, and is now a major general in the National Guard in command of the 49th Armored Division.

Tim de Jong, who was recently released from the Navy Civil Engineer Corps, has been reappointed to his prewar post of county engineer for Clatsop County, Oregon, with headquarters at Astoria.

Frederik N. Cronholm has gone abroad to make a study of land and water resources in the Near East for the Morrison-Knudsen Co., by which he is temporarily employed while on leave of absence from the U.S. Engineer Office at Salt Lake City, Utah.

Deceased

Ray Lester Allin (M. '39) consulting engineer of San Francisco, Calif., died on March 14. Mr. Allin, who was 59, was for many years on the engineering staff of the State of California. He had been regional engineer on water resources investigations for the state, and from 1923 to 1938 was hydraulic engineer in charge of the design and construction of the Hetch Hetchy Project. Later Mr. Allin was hydraulic engineer for the Marin Municipal Water District in charge of the enlargement of Alpine Dam. In his consulting work, he specialized in investigations of stresses in dams.

William Milnes Austin (M. '34) former principal highway engineer for the Public Roads Administration, died at his home in Charlottesville, Va., on April 27, at the age of 61. Mr. Austin was with the PRA from 1920 until his retirement in 1944. During this period he supervised the construction of a number of national park highways, including the Skyline Drive in Shenandoah National Park, Virginia. He also was principal highway engineer on the construction of the Central-American section of the Pan-American Highway, and located the Trans-Isthmian Highway in the Canal Zone.

Ray Elnathan Ballinger (Assoc. M. '25) civil engineer for the Los Angeles Bureau of Power and Light, Los Angeles, Calif., died on February 11, at the age of 54. Mr. Ballinger had spent his entire career in public utility work, having been with the Pacific Telephone and Telegraph Co., in San Francisco, and the Midway Gas Co., in Los Angeles. From 1919 on, he was with the Los Angeles Bureau of Power and Light.

Asa Carrington Barrow (Assoc. M. '31) for the past two years an engineer in the bridge designing division of the Kentucky Highway Department, died in Lexington, Ky., on March 30. Mr. Barrow, who was 70, divided his time between engineering and farming. From 1927 to 1938 he was on the civil engineering staff at Alabama Polytechnic Institute, and during the recent war was engaged on several emergency construction jobs in Kentucky.

John Taylor Chambers (M. '44) president of the Lewis-Chambers Construction Co., New Orleans, La., was fatally stricken on April 27 in Birmingham, Ala., where he had gone on a business trip. He was 62. Mr. Chambers had been assistant engineer on the construction of the New Orleans water purification plant and, as a partner in the Chambers-Morris Co., designed buildings for Tulane and Loyola universities. In 1928 he became president of the Lewis-Chambers Co., which has done extensive levee work in Louisiana and built 18 miles of the All-American Canal in California.

Oliver Dean Dales (M. '14) retired chief engineer of the Buffalo, Niagara & Eastern Power Corp., died in Clearwater, Fla., on March 27. His home was in Niagara Falls, N.Y. Mr. Dales, who was 72, had devoted his whole career to the power industry. From 1912 to 1929, he was engineer in charge of construction for the Niagara Falls Power Corp., building hydroelectric stations on the American side of the river. In 1929 he became engineer of construction for the Buffalo, Niagara & Eastern Power Corp., and from 1934 until his retirement in 1945 was chief engineer.

Ward Arnold Detwiler (M. '25) president of the Bryant & Detwiler Co., Detroit, Mich., died in June 1946, according to word just received by the Society. He was 65. From 1902 to 1905, Mr. Detwiler was with the Whitehead & Kales Iron Works, of Detroit, and in 1906 became a member of the firm of Bryant & Detwiler. Since 1909 he had been president of the firm, which specializes in general contracting and heavy construction.

Richard Griffith Develin (M. '07) retired engineer of Morristown, N.J., died there on March 24, at the age of 80. Mr. Develin spent his entire career with the Pennsylvania Railroad—for many years as assistant engineer, with headquarters in Philadelphia. He retired in 1934.

Orville Lamont Eltinge (M. '21) engineer of sewer design for the Sanitary District of Chicago, Chicago, Ill., died there on April 15, at the age of 62. Mr. Eltinge had been with the Sanitary District for almost 30 years—for 21 years in the post of engineer of sewer design. During this period he was responsible for the development of a number of the District's larger intercepting sewer projects. Earlier in his career he had been engaged on the construction of the New York State Barge Canal and, during the first World War, was a lieutenant in the Army Corps of Engineers.

Harry Darwin Knowlton (Assoc. M. '39) of Lakewood, Ohio, died on March 19. Mr. Knowlton, who was 52, was on the engineering staff of the City of Akron, Ohio, from 1915 to 1922. From the latter year to 1928, he was vice-president and general manager of the Alger & Knowlton Co., of Cleveland, and from 1928 to 1933 he was with the Van Sweringen Co., of Cleveland. Later he was president of the Valuation Service Co., of Lakewood, and associate regional coordinator in the Division of Defense Housing Coordination, Washington, D.C. He was the author of numerous articles on real estate.

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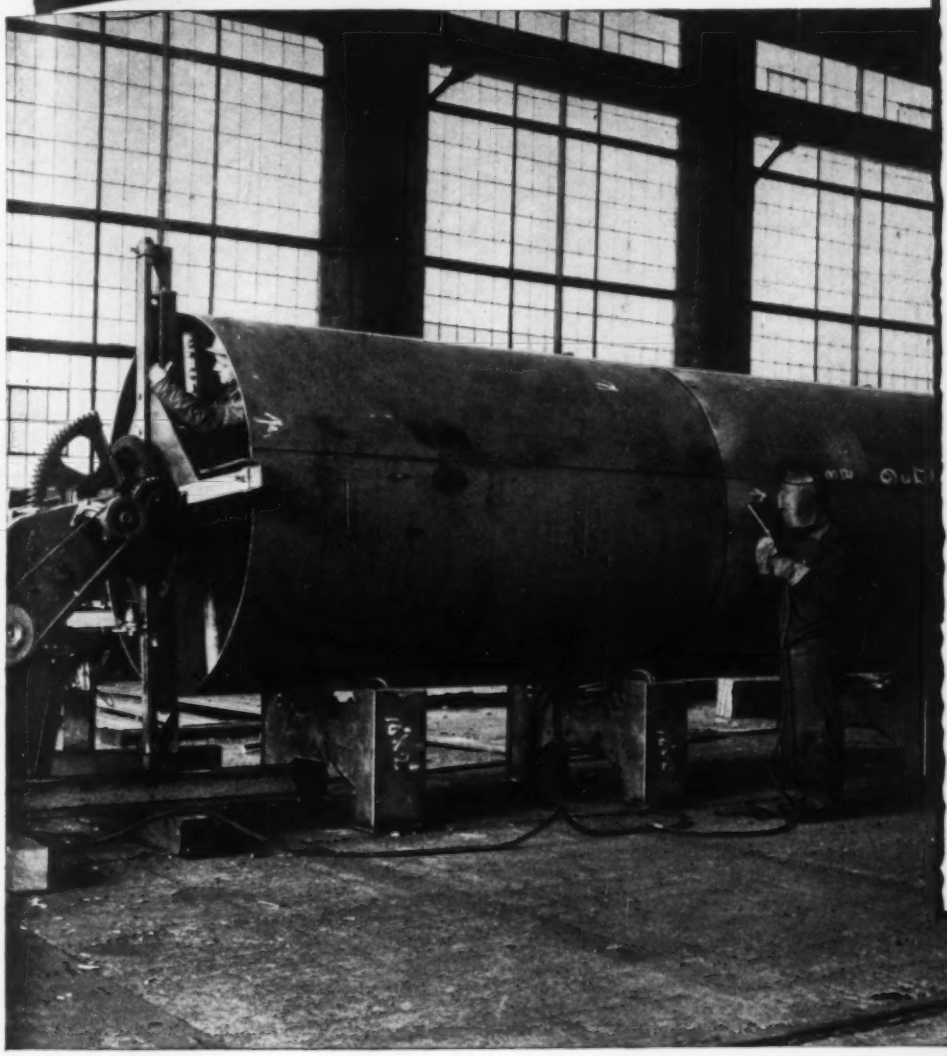

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T. R. Agg, Former ASCE Officer, Dies at Age of 68

NEWS OF THE DEATH of Thomas R. Agg, dean emeritus of engineering at Iowa State College—in Ames, Iowa, on May 7—will come as a shock to members of the Society, which he served long and indefatigably. He was Director from District

Thomas R. Agg
1878–1947

16 for the period, 1938 to 1940, and Vice-President from Zone III in 1943 and 1944. During his term as Director, he served as member and chairman of the Committee on Publications.

Dean Agg, who was 68, received the B.S. degree from Iowa State College in 1905 and the C.E. degree in 1914. He taught at the University of Illinois from 1905 to 1908, and from the latter year to 1913 was on the engineering staff of the Illinois Highway Department.

In the fall of 1913 he joined the civil engineering faculty at Iowa State College, becoming a full professor of civil engineering two years later. In 1931 he was named assistant dean of the division, and in 1932 became dean and director of the Engineering Experiment Station there. He retired on July 1, 1946, having remained at his post three years beyond the customary age limit for retirement because of heavy wartime schedules at the college.

In 1936 Dean Agg received the George S. Bartlett Award for outstanding service in highway engineering instruction and research. He was author of *Construction of Roads and Pavements* and joint author, with ASCE Past-President Anson Marston, of *Engineering Valuation*. He also wrote many research reports, published as Engineering Experiment Station bulletins, and general engineering papers that have appeared in Society and other engineering publications.

Michael Augustin Fouhy (M. '26) chief draftsman at the U.S. Naval Air Station, Floyd Bennett Field, Brooklyn, N.Y., died in that city on April 25. Mr. Fouhy, who was 61, had worked as a structural designer for several New York firms and, at one time, had a consulting practice in New York. For the past 15 years he had been in the Public Works Department of the Navy and had worked at Pearl Harbor, the Boston Navy Yard, and the Naval Air Station at Floyd Bennett Field. He held two patents on building and bridge designs.

John Ignatius Loyola Hogan (M. '31) civil engineer for the San Marco Construction Corp., White Plains, N.Y., died at his home there on March 27. His age was 64. From 1915 to 1928, Mr. Hogan was an engineer for the Bradley Contracting Co., and from 1928 to 1938 chief engineer for the Triest Contracting Corp., of New York City, on subway construction in Queens. From the latter year until 1943, he had an engineering and contracting practice in New York under the name of Hogan & Berman.

Magnus Lawrence Hydle (Assoc. M. '44) construction engineer for the Consolidated-Vultee Aircraft Corp., San Diego, Calif., died on January 29. Mr. Hydle, who was 61, was born and educated in Norway. Coming to this country in 1906, he was with the Northern Pacific Railway Co. for ten years. Later he was engaged on highway work in Oregon and California—from 1929 to 1942 as Junior highway engineer for the California Division of Highways. In the latter year he became structural engineer for the Consolidated-Vultee Corp.

Robert Lee McCormick (M. '25) of Brazil, Ind., died at a hospital in Terre Haute, Ind., on April 10, at the age of 80. Mr. McCormick spent his whole career at Rose Polytechnic Institute, having gone there as an instructor in civil engineering in 1891. He was promoted through the various grades, and from 1923 until his retirement in 1938 was professor of civil and architectural engineering. Mr. McCormick also had a part-time consulting practice in civil and mining engineering.

Harold Edmund Miller (Assoc. M. '16) of Cranston, R.I., died at his home there recently. He was 63. From 1907 to 1913 Mr. Miller was assistant engineer for the Rhode Island State Board of Public Roads. From 1914 on he was with the Southern New England Railroad Corp., serving as the organization's specialist in contract law.

Burdett Moody (M. '01) retired engineer of Los Angeles, Calif., died in September 1946. Mr. Moody, who was 80, spent his early career in mining engineering practice in Los Angeles, and from 1915 until his retirement in 1943 was business agent for the Los Angeles Bureau of Power and Light.

William Canon Muldrow (Assoc. M. '21) engineer, U.S. Corps of Engineers, Portland, Ore., died recently. He was 64. Mr. Muldrow had been chief engineer of the Interocean Barge and Transportation Co., Seattle, Wash., and manager of the Columbia Irrigation District at Kennewick, Wash. From 1934 to 1944, he was engineer-manager of the Sunnyside Irrigation District at Benton City, Wash. Mr. Muldrow had written on irrigation engineering and construction subjects for ASCE and other publications.

Former ASCE Director C. G. Dunnells Is Dead

THE MANY FRIENDS of former ASCE Director Clifford G. Dunnells, Pittsburgh consultant, will be grieved to hear of his death in that city on April 15. He was 72. Born in Pittsburgh, Mr. Dunnells was educated at the Western University of

Clifford G. Dunnells
1875–1947

Pennsylvania (now the University of Pittsburgh) and Lehigh University. His first work was with the Pittsburgh Bridge Co., and when that firm was taken over by the American Bridge Co. in 1900 he remained as assistant designing engineer.

In 1910 Mr. Dunnells joined the faculty of the Carnegie Institute of Technology. There he organized a department of building construction, said to be the first of its kind to be established in any American college. Mr. Dunnells was named associate professor and head of the new department at the time of its founding, and in 1918 was made a full professor. He became professor of civil engineering in 1933, when that department absorbed building construction subjects at Carnegie. He retired in 1943.

In addition to his teaching work, Mr. Dunnells also practiced structural engineering for a number of years, having formed a partnership in 1926 with E. N. Hunting, M. ASCE. Some of the most important commercial and industrial buildings in the Pittsburgh area were designed and built by this firm (now Hunting, Larsen & Dunnells).

Long interested in civic affairs, Mr. Dunnells served as a member of the Building Code Committee of the City of Pittsburgh from 1923 to 1926. Later he was chairman of committees preparing welding and reinforced concrete ordinances for the city.

A full member of the ASCE since 1913, Mr. Dunnells was elected by the Board of Direction to fill a vacancy in its membership in 1939. In 1940 he began a regular three-year term as Director. While on the Board, he was a member and chairman of the Committee on Publications. Mr. Dunnells also took an active part in the affairs of the Pittsburgh Section, which he served as president from 1935 to 1937.

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Edward John Landor (M. '88) retired engineer of Canton, Ohio, died in September 1946, at the age of 91, according to word just received at Society Headquarters. Mr. Landor began a long career as a bridge designer and builder in 1876, when he went to Canton as bridge engineer for the Wrought Iron Bridge Co. He left the firm in 1900 for brief engagements with the American Bridge Co. and the Dominion Bridge Co., and then established his own bridge and construction practice in Canton Before his retirement in 1932, he built a number of bridges across the Muskingum River, including the famous Y-bridge across the Muskingum and Tuscarawa rivers at Zanesville.

Frank Thompson Oakley (M. '00) engineer of San Francisco, Calif., died in Seattle, Wash., on October 31, 1946. He was 83. Early in his career, Mr. Oakley served as assistant engineer of Toledo, Ohio; as chief engineer on the construction of the Toledo & Western Railway; and as bridge engineer for the Northwestern Pacific Railway. From 1914 to 1921 he was senior structural engineer on railway valuation for the Pacific district of the Interstate Commerce Commission, and from 1924 to 1929 division engineer for the East Bay Municipal Utility District. Until 1940 he maintained a consulting practice in San Francisco.

William Ward Bernard Rhodes (Assoc. M. '45) of Sharon Hill, Pa., died on April 14, at the age of 54. Mr. Rhodes had held engineering positions with A. Bentley & Sons, of Toledo, Ohio, and E. B. Badger & Sons Co., of Boston, Mass., and from 1933 to 1941 was engineer for Lucas County, Ohio. More recently he was assistant engineer for the Boston engineering and contracting firm of Stone & Webster.

Julian Richmond (M. '19) chairman of the board of the Potdevin Machine Co., Brooklyn, N.Y., died in a hospital in Yonkers, N.Y., on April 12, at the age of 66. Mr. Richmond's first work was as a civil engineer for the City of New York on the construction of the first interborough subway. Later, he was with the New York Board of Water Supply, leaving to enter the Navy at the outbreak of the first World War. He had been connected with the Potdevin Co. since 1919—for many years as president.

John Ormond Riddel (M. '36) consulting engineer for the British government and director of the Trinidad Hydraulic Department, Port of Spain, Trinidad, died in April 1944, according to word just received by the Society. He was 57. Born and educated in Scotland, Mr. Riddel spent his early career on the construction of harbor, railway, and water supply projects for various British firms. In 1928 he was connected with Ulen & Co. in the planning and development of its large railway and harbor construction program in Persia. From 1929 to 1933, he was director of water and sewerage in the Bahamas, and in the latter year became resident engineer for the Trinidad government.

Joshua Stewart Sawyer (M. '30) manager of the asphalt department of the Shell Oil Co., New York City, died on April 6. Mr. Sawyer, who was 64, was also a director and vice-president of the Asphalt Institute. Mr. Sawyer first engaged in railroad and mining and, then, in highway construction work—as division engineer for the Oregon State Highway Commission. In 1929 he left the Commission to form an asphalt department for the Shell Oil Co. on the Pacific Coast, coming East in 1932 to accomplish a similar organization job for Shell in New York. He had been manager of the department, in charge of sales promotion and marketing, since the latter date.

J. S. Sawyer

Homer Reed Stanford (M. '01) rear admiral, CEC, U.S.N. (retired), died at Bethesda, Md., on April 7, at the age of 81. Commissioned an officer in the Navy Civil Engineer Corps in 1898, Admiral Stanford was in charge of the design and construction of numerous shore installations for the Navy, including drydocks, quay wall, radio and air stations, and hospitals. He was chief of the Bureau of Yards and Docks from 1912 to 1916, and retired from active duty in 1929. Admiral Stanford was author of a history of the Potomac River, and in 1917 won the Society's James Laurie Prize for a paper on the Pearl Harbor drydock.

Armen Haigouni Tashjian (M. '41) consulting engineer for the Union Metal Manufacturing Co., Canton, Ohio, died in that city on April 3. He was 66. A native of Armenia, Mr. Tashjian was educated at M.I.T., and later taught there. From 1912 to 1939 he was with the Cleveland architectural firm of Walker & Weeks—after 1920 as engineer member of the firm. Since 1939 he had been consultant for the Union Metal Co. on pile foundation problems.

Robert Raymond Tway (Assoc. M. '23) division engineer for the Oklahoma State Highway Department, Oklahoma City, Okla., died on August 21, 1946, according to word just received at Society Headquarters. Mr. Tway, who was 56, had been in the highway department since 1925. Prior to that he had taught at the Oklahoma State School of Mines, and from 1917 to 1922 was county engineer for Okmulgee County, Oklahoma.

Modern Structures Promote Development of North Africa

(*Continued from page 34*)

tains near Algiers—have been put in operation. Some hydro plants are under construction and others are in the blueprint stage. All of these plants are more or less interconnected and nearly all hydro projects serve irrigation purposes. In Algeria a number of small plants built along the irrigation channels generate energy used mostly for pumping stations.

Acknowledgments

The author wishes to express his gratitude to Mr. G. Gravier of Casablanca, Messrs. Weckel, Drouhin and Crosnier of Algiers, and Mr. Menetrier of Tunis, for the assistance received in obtaining information and particularly illustrations for this article. The great kindness and hospitality of all those with whom the author dealt in North Africa under the most trying and difficult conditions of the war years are also acknowledged.

Four Earthfill Dams Create Horsetooth Reservoir, Colo.

(*Continued from page 27*)

tooth Dam will discharge 400 cfs with a water surface at El. 5,300 and will have a discharge capacity of 2,500 cfs with a full reservoir. Discharges will be limited to 1,500 cfs, the capacity of the canal. The outlet will be formed by a concrete conduit located in a deep cut under the center of the dam. The upper 354 ft will be formed by a single circular tube of concrete $8\frac{1}{2}$ ft in diameter with side walls 2 ft thick. The lower 476 ft of the conduit will be of twin horseshoe construction with each horseshoe 10 ft in diameter. Six-foot-diameter steel penstocks will be placed in each horseshoe section. The two parts of the conduit are separated by a gate chamber housing two 5 × 5–ft high-pressure slide gates. These gates are for emergency use only or for times when repairs are made to the penstocks or valves at the downstream end. The intake to the outlet works is protected by a trashrack about 50 ft long and $9\frac{1}{2}$ ft high. At the lower end of the outlet conduit there is a valve house containing two 72-in. hollow jet valves for the precise control of the reservoir discharge. Below the valve house a stilling basin nearly 200 ft long is provided to reduce the turbulence and high velocity of the discharge from the valves sufficiently to prevent erosion to the canal directly below.

Tunnel Construction Adopted

There are some inherent advantages to having an auxiliary outlet through one of the canyon dams in preference to constructing a long side-hill canal to supply water to the

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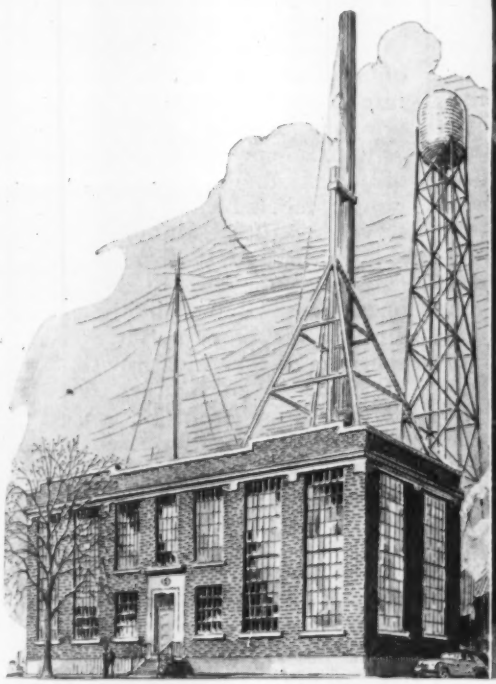

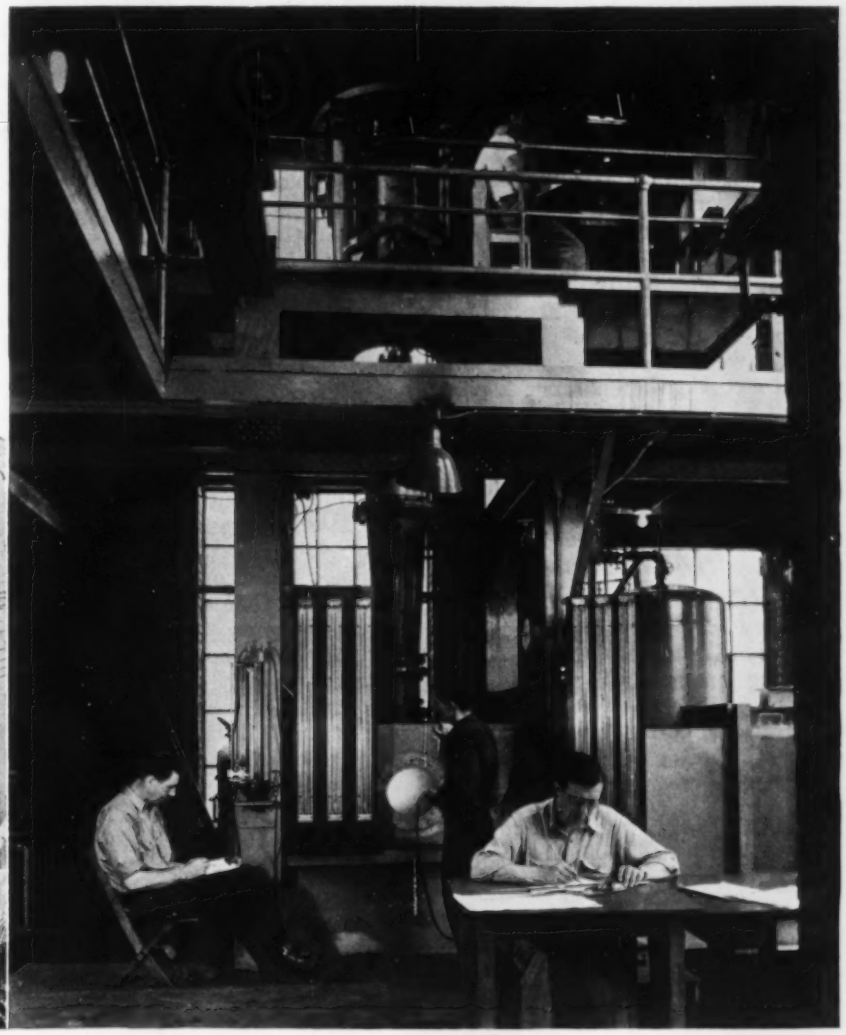

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area east to the reservoir. Preference was given at various times to different locations of such an outlet. The most recent work has been centered at the Soldier Canyon location. A conduit discharging between 40 and 80 cfs was specified for construction, part of which would be a 5-ft-dia circular conduit and part would be a 6-ft-dia horseshoe conduit.

However, further studies indicated advantages to tunnel construction. The plan adopted requires a 5-ft-dia, circular-section, pressure-reinforced tunnel upstream from the dam axis and a 6-ft horseshoe section downstream. A gate chamber separates the two parts. The intake, valve house, and other features follow conventional design practices.

Tests Assure Warning of Marine Borer Attacks

(*Continued from page 41*)

activity or growth of associated organisms and also provides a continuing record as the basis for research. The cost of maintaining the test boards has been borne wholly by the owners or lessees of the harbor properties.

Results of the analyses of these boards are, in turn, compared with the results from about 900 test blocks received by the laboratory every month from various coastal points in North, Central and South America and in the Pacific Ocean. Data are also received from similar research on marine borer activity that is being carried on in other countries, including England, France, Sweden and Australia.

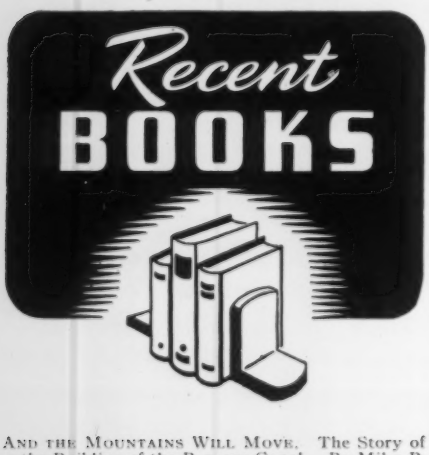
The test board is composed of removable untreated pine blocks of convenient size for shipment to the laboratory. The board is hung from above by a rope or chain, approximately 2 ft above the mud line, and must be weighted to eliminate excessive movement caused by tides or currents.

A series of numbered blocks and one unnumbered block are provided on each test board. Each month, the unnumbered block and one of the numbered series are removed and sent to the laboratory, and new blocks are substituted. On the *unnumbered* block are the organisms that have attached themselves during the previous month. The *numbered* block, removed in consecutive order, contains all the organisms that have lodged on it during the preceding 8 months. If the test board is kept up to date, the numbered block will contain a complete record from the time when a block of the same number was forwarded, eight months before.

Two types of standard test boards are used: (1) A plank to which 4 × 4 × 6-in. blocks are fastened; (2) a metal pipe or bar, with 6 × 12 × 1-in. blocks (Fig. 1). Where borer attacks are particularly severe, the 2-in. plank holding the blocks sometimes is destroyed in a brief time, requiring the use of the metal type of support.

On arrival at the laboratory the test blocks are catalogued. Records are kept of the test-board location, dates of submergence and removal, and date of receipt at the laboratory. Fouling organisms present on the surface of each block are listed and identified. Particular care is taken to record the number of organisms, as well as the size and rate of their growth on the basis of previous monthly findings. Rare or unusual specimens and organisms of questionable identity are removed, labeled, catalogued and preserved for future study.

When the study of fouling organisms is completed, the test block is opened up to determine the extent of any marine borer activity and the species. Size, rate of growth, breeding seasons and other data are determined from comparative monthly records. Specimens of wood revealing an unusual or severe attack are catalogued, labeled and retained at the laboratory in an exhibit of every known form of marine borer destruction.



AND THE MOUNTAINS WILL MOVE. The Story of the Building of the Panama Canal. By Miles P. Du Val. Stanford University Press, Stanford University (Calif.), 1947. 374 pp., illus., 9 × 6 in., cloth, $5. Begun while the author was captain of the port of the Pacific terminal of the Canal, this book is second in a proposed trilogy. It covers three phases of the exciting history of the Canal: the building of the Panama Railroad, 1849–1855; the "Great French Effort," 1879–1889; and completion of the Canal by the United States, 1904–1914.

APPLIED ENGINEERING MECHANICS. By A. Jensen, McGraw-Hill Book Co., New York and London, 1947. 316 pp., diagrs., tables, 9¼ × 6 in., cloth, $3. This book is intended to provide a text that meets the minimum requirements of the usual college course, but needs only an understanding of high-school mathematics. Mathematical manipulations have been replaced in large part by basic scientific reasoning from the physical concepts. The book is divided into the customary two sections—statics and dynamics—with a logical gradation from the elementary to the more involved concepts in each case.

CONVEYORS AND CRANES. By William H. Atherton. Pitman Publishing Corp., New York and Chicago, 1947. 357 pp., illus., tables, diagrs., 8½ × 5½ in., cloth, $5. This amply illustrated volume constitutes a valuable reference work on the design and application of conveying machinery and cranes. The machinery covered includes continuous elevators, stackers, skip hoists, transporters, and electric telphers.

COURSE OF REINFORCED CONCRETE DESIGN. By T. J. Bray. Chapman & Hall, London, England, 1946. 316 pp., plus 25 charts and graphs, diagrs., 10¼ × 6¾ in., cloth, 25s. Brief consideration is given in the early chapters to concrete materials, mixes, etc., as introduction to the design information which constitutes the main subject matter. Chapters on loads, stresses, reinforcement, and the various basic components of reinforced concrete structures precede the material dealing with specific types of structures, such as foundations, walls, tanks, towers, arches, etc. Various special topics—such as concrete roads and surfaces, bearing pressures, and the characteristics of aggregates—are included in the appendix.

THE HIWASSEE PROJECT. U.S. Government Printing Office, Washington, D.C., 1945. 367 pp., illus., tables, diagrs., charts, 9×6 in., cloth, $1.25 (apply to the Superintendent of Documents, Washington, D.C.). Published by the Tennessee Valley Authority as Technical Report No. 5, the present volume describes the planning, design, construction, and initial operations of the Hiwassee Dam and Reservoir. It covers preliminary investigations for the project; dam and powerhouse design; access routes to the dam site; construction methods, including construction plant and river diversion; relocation and adjustments made necessary by creation of the reservoir; and a complete summary of costs.

HYDRAULIC MEASUREMENTS, 2 ed. By H. Addison. John Wiley & Sons, New York, 1946. 327 pp., illus., diagrs., charts, tables, 8¾ × 5½ in., cloth, $5. This manual for engineers is an amplification of the last chapter of the author's *Textbook of Applied Hydraulics*. Wholly practical in treatment, the book covers the measurement of both open channel flow and flow in pipes and conduits. It deals with liquids only, omitting any discussion of gas metering. The final chapter covers indicating, recording, and integrating instruments. There is a bibliography.

MECHANICS OF MATERIALS, 2 ed. By P. G. Laurson and W. J. Cox. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 422 pp., illus., diagrs., charts, tables, 8½×5½ in., cloth, $4. With the needs of the student in mind, this text presents a full treatment of the fundamentals required for a minimum course. Additional chapters on the more advanced aspects of beam and column analysis, stresses and deflections, loaded connections, etc., are included to provide fuller coverage for those who wish it. The physical behavior of stressed bodies has been emphasized throughout as well as the mathematical expression of this behavior. More than 600 graded problems are provided.

PORTLAND CEMENT TECHNOLOGY. By J. C. Witt. Chemical Publishing Co., Brooklyn, N.Y., 1947. 518 pp., illus. diagrs., charts, maps, tables, 8¼×5½ in., cloth, $10. The manufacture of portland cement is dealt with comprehensively from the selection of the raw materials to the analysis and testing of the finished product. The necessary processes are discussed in detail, including the mechanical equipment, power and fuel requirements, output and cost figures, storing and shipping. Three chapters are devoted to concrete materials and concrete technology. A broadly classified 30-page bibliography is appended.

PRINCIPLES AND PRACTICE OF SURVEYING, Vol. 2, Higher Surveying, 6 ed. By C. B. Breed and G. L. Hosmer. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 674 pp., illus., diagrs., charts, tables, 7½×4½ in., cloth, $4.50. The five sections of this standard work have been generally revised to conform to current practice. Part I deals with survey control, astronomical observations, leveling practice; Part II, with topographical surveying by the stadia and plane-table methods, with discussion of the relation of geology to topography; Part III, with ground, aerial, and stereo-photogrammetry; Part IV, with hydrographic surveying and stream gaging; and Part V, with constructing and finishing maps. Effectively illustrated, the volume also contains some 30 pages of tabular data in addition to that included with the text. Methods for the adjustment of triangulations and level circuits are appended.

(*Continued on page 104*)

H-Section Welded Truss Has Wide Adaptability

By J. K. GANNETT, Vice President and Director of Engineering and Research
The Austin Company
Cleveland, Ohio

THE standard H-section welded truss designed by The Austin Company greatly simplifies the designing of one-story industrial buildings and effects many economies in their construction.

The truss, using H-Sections with all webs in a vertical plane and with all connections made by direct fillet welds without the use of gusset plates, is shop-fabricated in standard 50, 60, 70 and 80-foot lengths. It is readily adaptable to different loadings by simply changing the weights of the beams used for the various members. The depths need not be changed, thus standard jigs are used for economical fabrication. Fig. 1 shows one of the trusses being finish-welded.

The top chord is a wide flange beam that can carry purlins at a variety of spacings without regard to panel points, and is also adaptable to continuous uniform loading. The bottom chord can carry loads at any point and can be used as a monorail. See Fig. 2. Thus the truss is adaptable to a wide variety of loading demands and factory arrangements which ordinarily require specially-designed trusses.

Economical Fabrication

Fabrication is quite economical because it has been reduced to three simple operations: cutting the members to length, assembly and welding.

Since the truss members are abutting instead of lapping, it is important that they be cut to exact length and angle. A large friction saw is satisfactory for cutting the chord members, while an abrasive saw is used to cut web members to the exact angle required.

For assembly, the members are simply "laid in place" in the horizontal jig. Jigs greatly reduce production costs and insure that the webs of all members are placed in precisely the same plane. Monorail hoists are used to place the chords, but the short web members are usually so light that two men can quickly place them by hand.

After the truss is tack welded, it is removed from the jig and stood on its bottom chord, being held at the top by monorail hoists. The bottom chord joints are then finish welded as shown in Fig. 1. Then the truss is turned upside down and all top chord joints welded. This procedure permits 100% down-welding.

Fig. 1. Finish-welding diagonal and vertical web members to bottom chord of an H-truss.

All of the welds are fillets, ranging from ¼″ to ⅜″, depending on the size of the truss and the location. A 50-foot truss requires a total of 41 lineal feet of fillet welds.

No Cut Edges Exposed

The fillets are run completely around the members at their end connections. Thus all cut edges are covered and only the original rolled surfaces are exposed, which increases resistance to corrosion and simplifies painting and maintenance.

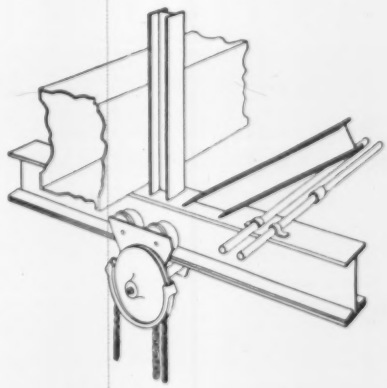


Fig. 2. How bottom chord can be used to support various loads and serve as monorail.

This fabrication procedure exemplifies the economy and simplicity obtainable in structures of good welded design. There is no punching, coping or chipping; no templates are needed; all welding is the simplest possible—horizontal fillet welding; and, except for the end connection, every pound of steel is in a truss member—there is no detail material such as gusset plates, fillers or stiffeners.

This truss has been thoroughly tested and has been—or is being—incorporated in Austin buildings, from coast-to-coast with an aggregate floor space of over three million square feet.

New developments in welded design are thoroughly described in "Studies in Structural Arc Welding," available free to engineers. Write The Lincoln Electric Company, Dept., 273 Cleveland 1, Ohio.

APPLICATIONS FOR ADMISSION OR TRANSFER

June 1, 1947 Number 6

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ANDERSON, THOMAS WILLIAM (Jun.) (Age 35) Comdr. CEC, U.S. Navy, being Asst. Public Works Officer and Industrial Relations Officer, Great Lakes Naval Training Center, Waukegan, Ill.

BALLENGER, ROBERT DANIEL (Assoc. M.) (Age 38) Structural Engr., War Dept., U.S. Engrs., Curundu, Canal Zone.

BECKER, ELMER WILLIAM (Age 45) Civ. Engr. III, being Asst. to Engr. of Distribution, Constr. Div., Milwaukee Water-Works, Milwaukee, Wis.

BENGI, NECDET AHMED (Jun.) (Age 35) Chf. Engr. and Co-Partner of Contr., Constr. of Univ. Bldg., Istanbul, Ankara, Turkey.

BIRKENWALD, EMIL S. (Assoc. M.) (Age 46) Engr. of Bridges, Southern Ry. System, Cincinnati, Ohio.

BRIELMAIER, ALPHONSE ANTHONY (Assoc. M.) (Age 42) Associate Prof. of Civ. Eng., Pennsylvania State Coll., Dept. of Civ. Eng., State College, Pa.

BROWDER, EDWARD MARION, JR. (Assoc. M.) (Age 41) Planning Engr. (P-5), Office of Asst. Engr. of Maintenance, The Panama Canal, Balboa Heights C.Z.

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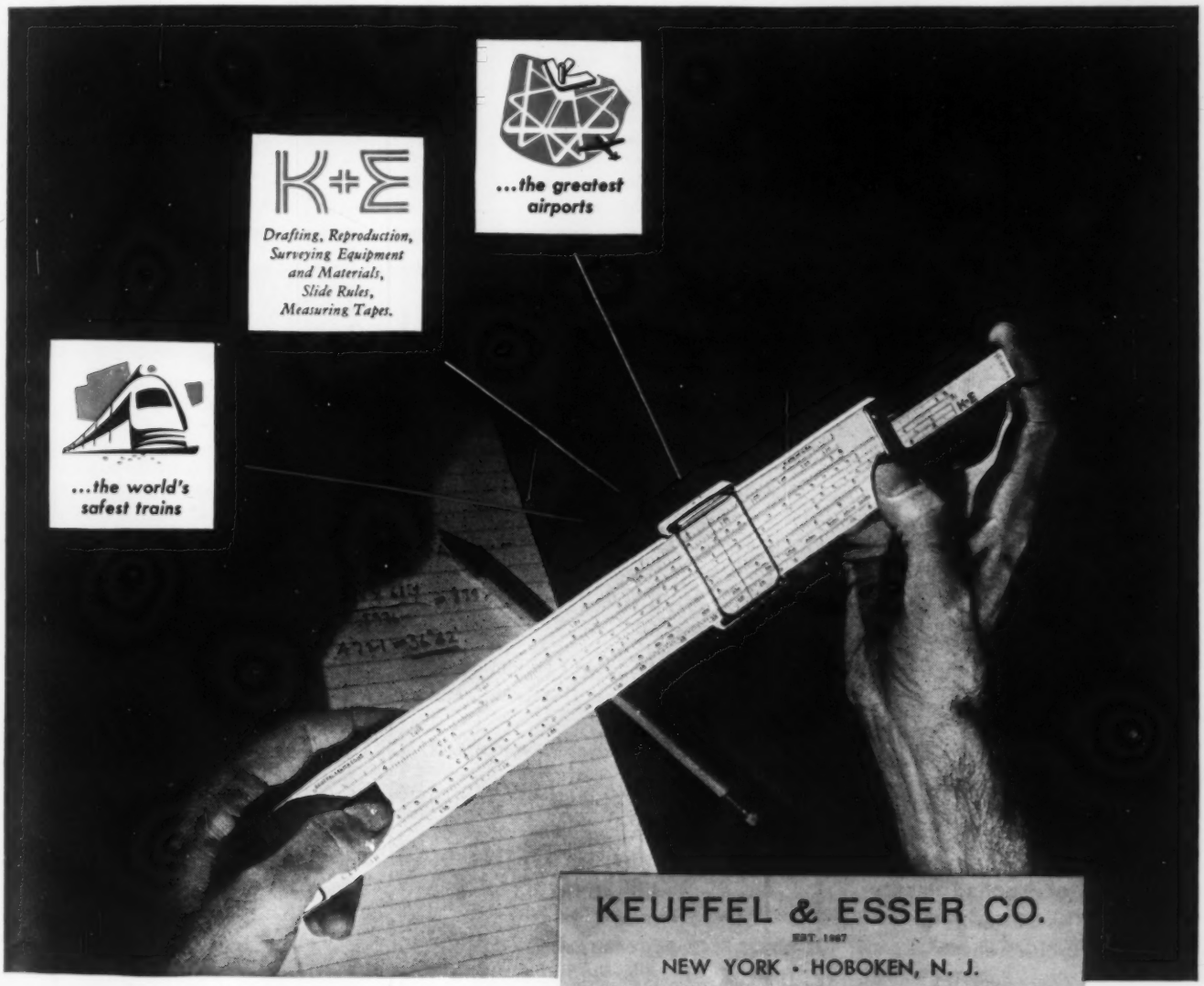
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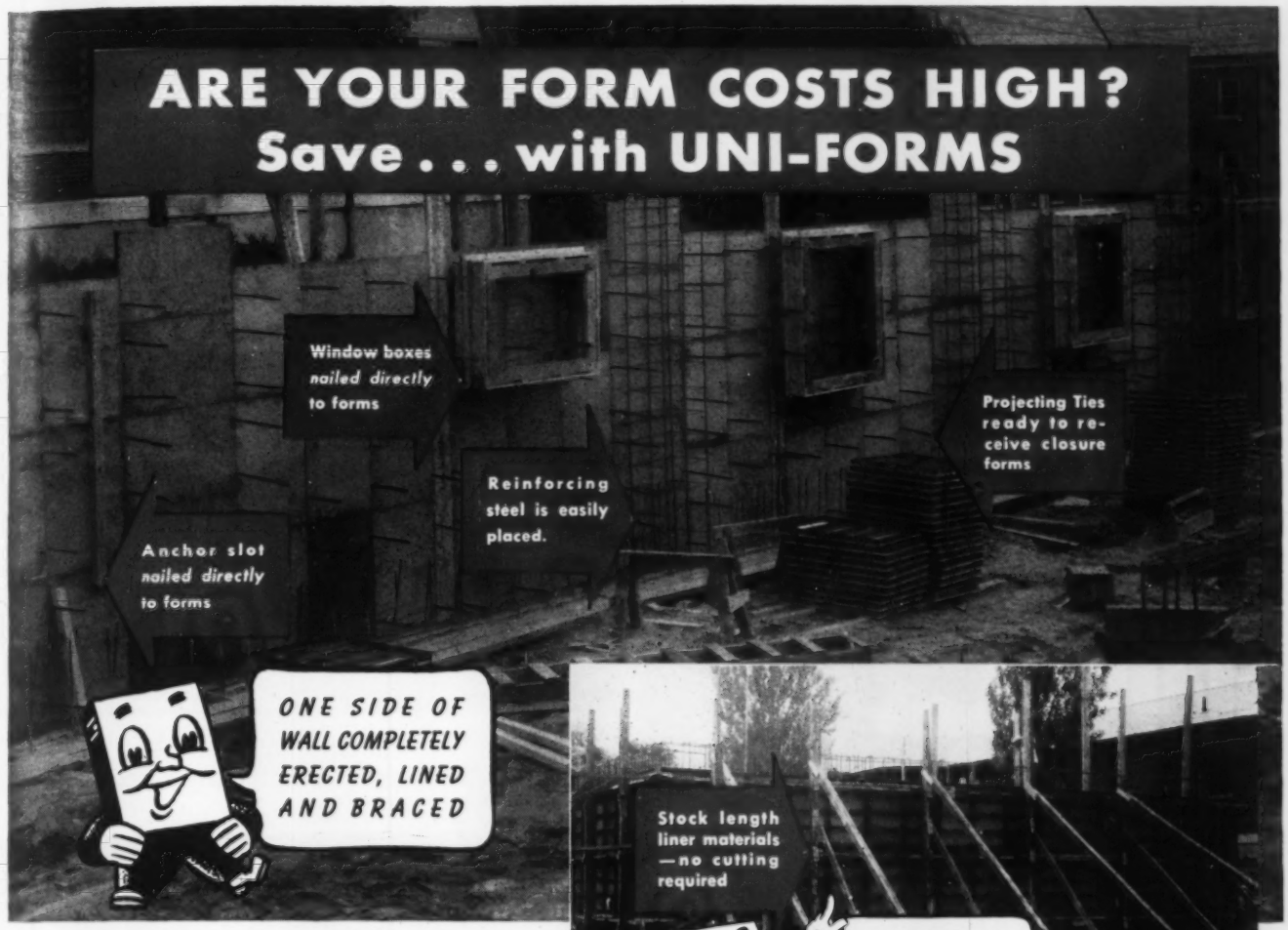
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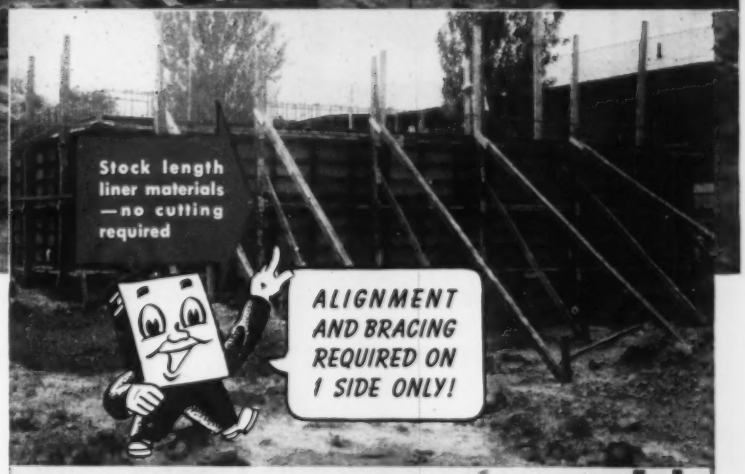

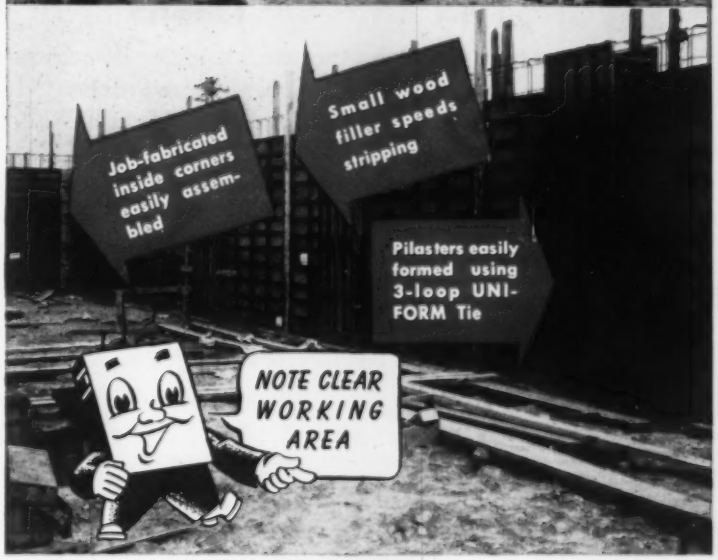
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HOOPER, WILLIAM THOMAS FRANCIS, JR. (Jun.) (Age 32) Asst. Prof. of Civ. Eng., Northwestern Univ., Grayslake, Ill.

HUDA, A. F. M. MIRZA SHAMSUL (Age 30) Graduate student, Univ. of Toronto, Toronto, Canada. (Permanent address, Calcutta, India.)

JENKS, DOWNING BLAND (Jun.) (Age 31) Trainmaster, Great Northern Railway, Minneapolis, Minn.

JONES, RALPH WILLIAM (Age 43) Asst. Prof., Univ. of Delaware, Newark, Del.

KENDREW, CHARLES ALBERT (Age 34) Engr. (Hydraulic) P-1, U.S. Engr. Dept., Baltimore, Md.

KOCH, ERNEST JOSEPH, JR. (Age 48) Eng. Aide V, Los Angeles County Flood Control Dist., Los Angeles, Calif.

LADUE, WILLIAM EDWARD (Jun.) (Age 35) With E. D. Francis, Cons. Engr., Sacramento, Calif.

LEWIS, ROBERT LLOYD (Jun.) (Age 34) Prof. of Civ. Eng. and Head of Dept., Colorado A. & M. Coll., Fort Collins, Colo.

LYLES, WILLIAM GORDON (Age 33) Member of firm, Stork & Lyles, Archts., Columbia, S.C.

MALLERY, JESSE CARL (Age 39) Civ. Engr. with Ralph W. O'Neill, Cons. Engr., Glendale, Calif.

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STALEY, JOSEPH FREAS, JR. (Age 40) Civ. Engr. (Design Div.), E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

STROH, CHARLES KIRK (Age 49) The Chester Engrs., Pittsburgh, Pa.

TAYLOR, EDWARD HOLBROOK (Jun.) (Age 35) Asst. Prof. of Eng., Univ. of California, Los Angeles, Calif.

THOMPSON HOMER FERDINAND (Age 40) Graduate student, and Instructor in Drawing Dept., Missouri School of Mines and Metallurgy, Rolla, Mo.

TIRY, ROBERT FRANCIS (Age 32) Asst. Structural Engr., Structural Design Dept., TVA, Knoxville, Tenn.

VALENTE, GEORGE ANTHONY (Jun.) (Age 35) Constr. Engr., Calnaught Constr. Corporation, Flushing, N.Y.

WANKE, IRVIN ROBERT (Jun.) (Age 32) Structural Designing Engr., Grade V, Quinton Engrs., Ltd., Los Angeles, Calif.

WOODWARD, RICHARD JOSEPH, JR. (Age 39) Graduate student, Teaching Asst. and Lecturer in Civ. Eng., Univ. of California; also with Office of Bldg. Inspector, Vallejo, Calif.

YANK, HERMAN VICTOR (Jun.) (Age 32) Structural Engr. with A. W. Earl, Cons. Engr., San Francisco, Calif.

ZELNICK, ERNEST WILLIAM (Jun.) (Age 30) Associate Engr., Office Eng. Div., The Panama Canal, Balboa Heights, Canal Zone.

APPLYING FOR JUNIOR

BORDEU, EDMUNDO (Age 27) Projecting Engr. Empresa Nacional de Electricidad, Santiago, Chile.

BRETT, JOHN EDWARD (Age 27) Cons. Engr. Montreal (28), P.Q., Canada.

DABBAS, EDWARD NIZAR (Age 24) Graduate student, Lehigh Univ., Bethlehem, Pa.

DENNEY, J. C. (Age 26) Civ. Engr., Humble Oil & Refining Co., Stratton Dist., Kingsville, Tex.

HALLOCK, DONALD NICHOLSON (Age 24) Student, Graduate School of Eng., Harvard Univ.; address Reedley, Calif.

KIRCHER, FREDERICK JOHN (Age 22) Structural Designer and Draftsman, Seelye, Stevenson & Value, New York City.

MONTGOMERY, WILLIAM SLACK (Age 27) Asst. Engr. for a general contractor, Dallas, Tex.

ORTOLEVA, RICHARD (Age 30) Designer, E. B. Badger & Sons Co., Boston, Mass.

POLACCO, JORGE (Age 25) Asst. Chf. Engr., Housing Dept., São Paulo Tramway, Light & Power Co., Ltd., São Paulo, Brazil.

RAMIREZ, RENE OCTAVIO (Age 24) Asst. Archt., Municipal Housing Authority, also Archt. and Constr. Engr. (private practice), San Juan, Puerto Rico.

SPARBY, EGIL WILFRED (Age 32) Jun. Civ. Engr. with George F. Hardy, Cons. Engr., New York City.

WILCOX, ROSS GOLDEN (Age 26) Asst. Traffic Engr., National Safety Council, Evanston, Ill.

UNIV. OF AKRON

FOX, THOMAS ANDREW, JR., 1947 — AGE (22)

CASE SCHOOL OF APPLIED SCI.

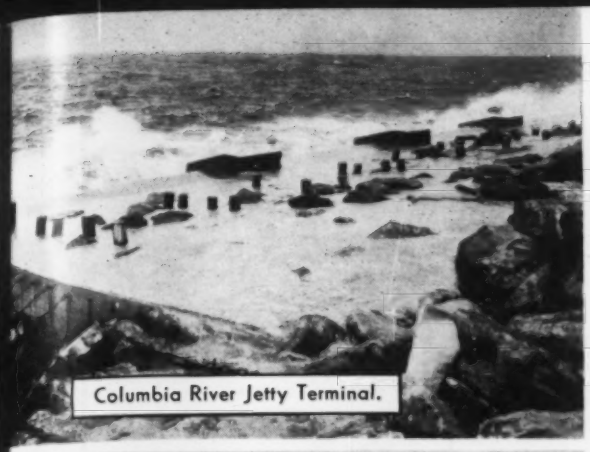
PIEPER, FREDERICK AUGUST, 1947 (23)

COLO. A & M COLL.

BURTON, LEROY HAROLD, 1947 (25)

COLUMBIA UNIV.

FOOTE, ROBERT LAWRENCE, 1945 (21)
SOZIO, JOSEPH, 1944 (27)



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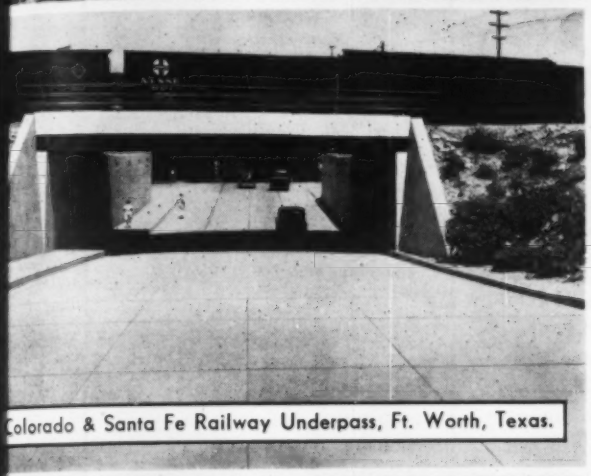
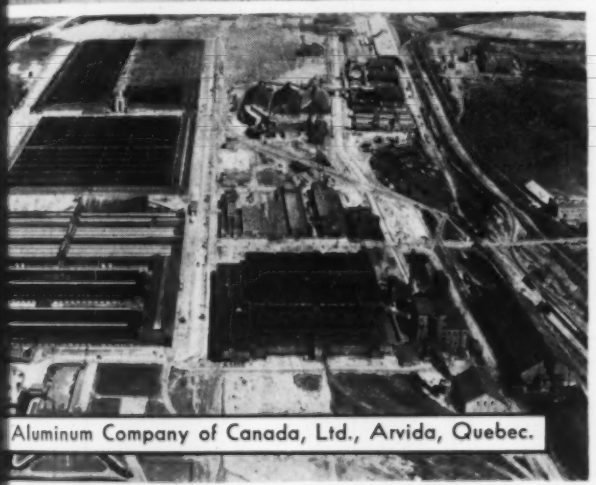
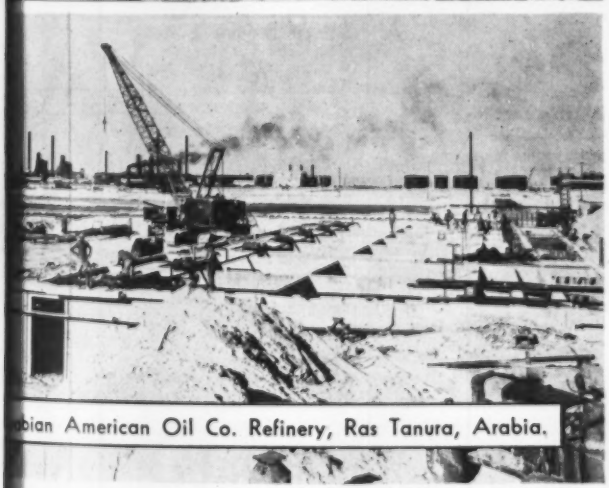


Colorado & Santa Fe Railway Underpass, Ft. Worth, Texas.



Aluminum Company of Canada, Ltd., Arvida, Quebec.



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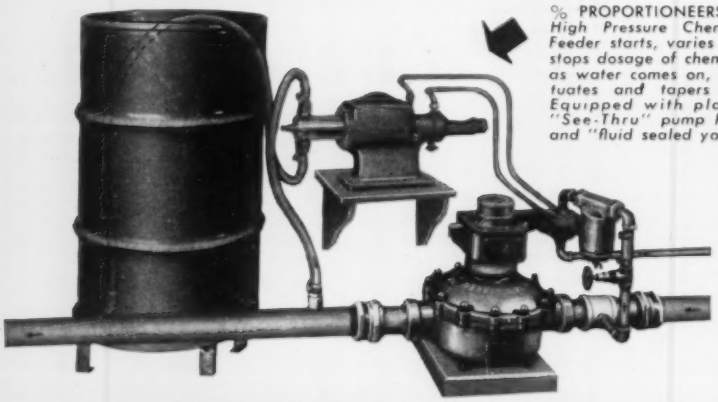

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FLOOD, JOHN HEBARD, JR. (26)

GA. SCHOOL TECH.

FOSS, EDWARD ROBERT, JR., 1946 (24)

ILL. INST. TECH.

ASROW, SHERWIN PRESTON, 1944 (24)
PHILIPPS, LOUIS JOHN, 1947 (26)
VOXEN, JOHN EDWARD, 1944 (27)

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ABRAMSON, EDWIN JOHN, 1947 (21)
ADAMS, RICHARD STANFORD, 1947 (24)
BEATTY, FREDERICK KEATON, II, 1947 (20)
FATHAUER, JACK ELMER, 1947 (22)
JAMISON, WILLIAM HENRY, 1946 (29)
KING, PHILIP VICKERY, 1947 (24)
KOCH, LEONARD VERNON, JR., 1947 (22)
LANDWEHR, ROGER GEORGE, 1947 (23)
MERTEN, BRUCE GEORGE, 1947 (23)
NIELSEN, WARREN VICTOR, 1947 (22)
PANEK, MILES EMIL, 1947 (23)
SCHAEFER, REUBEN EDWIN, 1947 (26)
VEENSTRA, HENRY ROBERT, 1947 (25)
WATKINS, DANIEL JOSEPH, 1947 (23)

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LAIRD, LOUIS CALVIN (21)
WEILAND, EUGENE TRUMAN, 1946 (22)

UNIV. OF KANS.

BLACK, CHARLES THOMAS, 1947 (21)
COOK, RONALD ROY, 1947 (23)
DELANO, CHARLES FISHER, JR., 1947 (24)

UNIV. OF LOUISVILLE

BEARD, GRAYDON BENNETT, 1947 (23)
CHANCE, JAMES EDWARD, 1947 (22)
GRAFF, WILBUR LEE, 1947 (24)
PARSONS, WILLIAM EUGENE, 1947 (23)
PORTERFIELD, WILLIAM CARLYLE, 1947 (22)

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HEISER, WARREN GEORGE (25)

MICH. STATE COLL.

THEROUX, ROBERT JOSEPH, 1942 (26)

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AXELSON, JOHN ALBERT, 1947 (24)
CHENG, DAVID HONG, 1947 (27)
ENGLUND, ROBERT WOODROW, 1947 (24)
EYBERG, QUENTIN CHARLES, 1947 (25)
GRIEDER, ROY EDWIN, 1947 (26)
MORRIS, JOHN GORDON, 1947 (24)
SPARTZ, ELMER DARWIN, 1947 (23)
TUCKERMAN, GEORGE EDGERTON, JR., 1947 (30)

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NERSESIAN, SEROP SEBOUGH, 1943 (23)
NICOLAIDES, MARY (20)

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SOMMER, ADAM, 1946 (30)

UNIV. OF N. DAK.

OLSON, MAURICE CLAIRE, 1947 (26)

NORTHEASTERN UNIV.

JOHNSON, CARL GODFREY, JR., 1943 (26)

UNIV. OF NOTRE DAME

CARTIER, MORGAN EDWARD, JR., 1947 (22)

UNIV. OF OKLAHOMA

IRBY, HOWARD EDGAR, 1945 (21)

R.I. STATE COLL.

KOZAK, JOHN JOSEPH, 1942 (26)

UNIV. OF S.CAROLINA

MCEACHERN, COOPER, 1947 (23)

S.DAK. SCHOOL OF MINES

MALONE, ROBERT EMMETT (25)

STANFORD UNIV.

LIPPINCOTT, WILLIAM ROMAN, JR. (23)
MURPHY, ROBERT WILLIAM (26)

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CHAPMAN, JAMES THOMAS, 1943 (25)

VA. POL. INST.

KRAFT, ALLISON FULLER, 1947 (27)
ROBINSON, WILLIAM GETMAN, 1947 (25)

UNIV. OF WASH

BORNHOFT, ARLIE, 1947 (23)
HAWLEY, NORMAN DURELL, 1947 (26)
JOHNSON, MELVERN EDWARD, 1947 (33)
REAM, NORMAN LOFTUS, 1947 (24)
SCHENK, CLINTON DARLING, JR., 1947 (31)

UNIV. OF WIS.

KORPADY, EDWARD ALFRED, 1946 (25)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Changes in Membership Grades

Additions, Reinstatements, Transfers and Resignations

From April 10 to May 9, 1947, Inclusive

Additions to Membership

AGLER, ROBERT DEAN (Jun. '46) Civ. Engr., Hayden, Harding & Buchanan, Park Sq. Bldg., Boston (Res., 35 Central St., Auburn), Mass.

ANTONI, CHARLES MICHAEL (Assoc. M. '47) Asst. Prof. of Civ. Eng., Cornell Univ., Lincoln Hall (Res., 423 Oak Ave.), Ithaca, N.Y.

AXELROD, CHARLES (Jun. '47) Junior Weight Engr., The Glenn L. Martin Co., 424 South Drew St., Baltimore 24, Md.

BAILEY, WILLIAMS DUNLAVY (M. '47) Supervising Civ. Eng., Seelye, Stevenson & Value, 101 Park Ave., New York, N.Y.

BEENEY, HERBERT KESTER (Assoc. M. '47) Structural Engr., U.S. Engrs., War Dept., Box 300, Fort Lincoln, Bismarck, N.Dak.

BENHAM, DAVID BLAIR (Assoc. M. '47) Cons. Engr. (Benham Eng. Co.), 550 American National Bldg., Oklahoma City, Okla.

BRUNER, LEON CHARLES (Assoc. M. '47) Senior Airways Engr., Civ. Aeronautics Administration, Ninth Region, Box 4009, Honolulu, T.H.

BUHR, VICTOR WILLIAM (M. '47) (Victor W. Buhr, Associates), Box 1068, Salisbury, Mo.

BUSH, ROBERT YOUSE (Jun. '46) Safety Engr., Employers' Mutual, 2017 P.S.F.S. Bldg., Philadelphia 7 (Res., Bechtelsville), Pa.

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CHEEK, WALTER DOUGLAS (Jun. '46) Junior Structural Engr., Cunningham-Rudy Co., 3087 West Grand, Detroit (Res., 494 North Dr., Wyandotte), Mich.

CHIBARO, ANTHONY (Assoc. M. '47) Structural Engr., Jackson & Moreland, 31 St. James Ave., Boston (Res., 58 Paulson Rd., Waban), Mass.

CHILDS, ELLIOT FULLER (Assoc. M. '46) Senior Engr. (Hydr.), Corps of Engrs., War Dept., Park Square Bldg., Boston (Res., 42 Madison Ave., Newtonville 60), Mass.

CLIFFORD, CARLETON MERRITT (M. '46) Col., Corps of Engrs., Western Ocean Div., Box 156, Sausalito, Calif.

CRAFT, WELLING HALL (Assoc. M. '47) Secondary Road Engr., Calavera and Alpine Counties, Calif., 197 Redding Road, Campbell, Calif.

CRAIG, WILLIAM BARNARD (Assoc. M. '47) Hydr. Engr., Omaha Dist. Office, Corps of Engrs., 1709 Jackson, (Res., 1308 Franklin, Bellevue), Omaha, Nebr.

DAILY, JAMES WALLACE (Assoc. M. '47) Asst. Prof. of Hydraulics, Massachusetts Inst. of Technology, Cambridge 39, Mass.

DE VOS, WOUTER (Assoc. M. '47) Cons. Engr., P.O. Box 1892, Johannesburg, South Africa.

DOUGLASS, ROBERT THOMAS (Jun. '47) 214 Connolly St., West Lafayette, Ind.

DRUMMOND, DONALD HOLLAND (Jun. '47) (D. H. Drummond Builder), 11 East 62d Terrace, Kansas City, Mo.

ELMQUIST, FRANS GUNNAR (Assoc. M. '47) Cons. Engr., Persson Eng. & Constr. Co., 2335 West Devon Ave. (Res., 6656 North Rockwell St.), Chicago 45, Ill.

EWELL, JOHN FRANCIS (Jun. '47) with U.S. Army, 1838 Fendall Ave., Charlottesville, Va.

FIGILIS, JACK (Assoc. M. '46) Chf. Structural Engr., American Crystal Sugar Co., Boston Bldg., Denver (Res., Rt. 8, Box 259, Lakewood), Colo.

FORBES, FRANK FIELD (Jun. '46) Asst. Civ. Engr., City of South Pasadena, City Hall (Res., 1740 Raymond Hill Rd.), South Pasadena, Calif.

GAFFORD, WILLIAM ROGERS (Jun. '46) Instr. in Eng. Drawing, Univ. of New Mexico, Albuquerque, N.Mex.

GILFETHER, CYRIL ROBERT (Assoc. M. '47) Civ. Engr., A. J. McCosker, Box 6, Station A., Berkeley (Res., 12 Nace Ave., Piedmont 11), Calif.

GRAU, FRED HERMAN (Assoc. M. '47) Design & Field Engr., Myers & Noyes, 320 Nixon Bldg., Corpus Christi, Tex.

GUZMAN, JOSEPH SATURN (Jun. '47) Junior Engr., Pacific Electric Ry. Co., 610 South Main St., Rm. 660 (Res., 229 North Rowan Ave.), Los Angeles 33, Calif.

HAMILTON, ROLLAND MORRIS (Jun. '47) Civ. Engr., State Highway Comm., Design Dept., Masonic Temple (Res., 630 Warren), Topeka, Kans.

HAMLYN, RICHARD LOUIS (Jun. '47) Stephens & Hamlyn, 622 North First St. (Res., 24 West Holly St.), Phoenix, Ariz.

HANLEY, TURE JOHN (Assoc. M. '47) Engr. (Hanley & McDowell Engrs.), 2524 Gundry (Res., 2710 Caspian Ave.), Long Beach 6, Calif.

HART, SCOTT PARK (M. '47) Materials Engr., State Highway Dept. (Res., 2005 Jerome Pl.), Helena, Mont.

HARVEY, RICHARD THOMPSON (Assoc. M. '47) Civ. Engr., P-3, Corps of Engrs., 954 Ellicott Sq. Bldg., Buffalo 3, N.Y.

HEGE, WILLIAM DAVID (Assoc. M. '47) Asphalt Sales Engr., Caltex (India) Ltd., Caltex House, Ballard Estate, Bombay, India.

HENSCH, ERWIN FREDERICK (Jun. '46) Structural Designer, Toltz, King & Day, Engr. & Archts., 1509 Pioneer Bldg., St. Paul (Res., 4316 Forty-first Ave., S., Minneapolis), Minn.

HOAR, VERNE, JR. (Jun. '46) Stress Analyst, Grumman Aircraft Eng. Corp., Bethpage (Res., 30 Long Beach Ave., Roosevelt), N.Y.

HUGHES, HOMER LITTLEFIELD (M. '47) Chf. Engr., Tampa Marine Repair Co., P.O. Box 1171, Tampa, Fla.

HUNT, CHARLES ALDEN (Jun. '46) Engr., Fargo Eng. Co., 120 West Michigan Ave. (Res., 1028 South Wisner), Jackson, Mich.

HURLEY, ROBERT PATRICK JAMES (Jun. '47) Engr., Walter Kidde Constructor, 205 Seward Ave., Utica, N.Y.

JACKSON, HOWARD NELSON (Jun. '47) Engr., Klug & Smith Co., 111 East Wisconsin Ave., Milwaukee (Res., Route 2, Box 465, Hales Corners), Wis.

JONES, GLYNDWR MALCOLM (Jun. '47) Asst. Engr., State Hydro Electric Dept., Clearburn, Kurow, New Zealand.

KULOW, WAYNE FREDRICK (Jun. '47) Structural Engr., Deere & Co., Architectural Eng. Dept., Moline (Res., 2250 Twenty-fourth St., Rock Island), Ill.

KWINN, EDWARD STANLEY (Jun. '47) Junior Engr., Inland Steel Co., Indiana Harbor (Res., 6340 South Albany Ave.), Chicago 29, Ill.

LARSEN, SAMUEL THORVALD (Assoc. M. '47) Project Supt., U.S. Bureau of Reclamation, Newell, S.Dak.

LELIAVSKY, SERGE (M. '47) Director Designing Service, Reservoirs & Nile Barrages Dept., Ministry of Public Works, Cairo (Res., 52 Street 83, Maadi), Egypt.

LEONARD, EDWIN RAY (M. '47) Associate & Structural Engr., Fred Elswick, Archt., 1303 Heyburn Bldg., Louisville, Ky.

LOTH, MORITZ AUGUSTUS RUST (Assoc. M. '47) Highway Engr., Public Roads Adm., Federal Works Agency, 410 State & City Office Bldg. (Res., 328 Avenham Ave.), Roanoke 14, Va.

LYTLE, AND BENJAMIN (Jun. '47) Structural Engr., J. F. Beasley Constr. Co., 20 North Wacker Dr., Rm. 1741, Chicago, Ill.

MANNING, TRAVIS LIONEL (Jun. '47) Engr. Aid, Los Angeles Flood Control Dist., 1640 Eastlake, Los Angeles (Res., 213 East Garvey Blvd., Wilmar), Calif.

MARSTON, ANSON DAY (M. '47) Col., U.S. Army, Corps of Engrs., Command & Staff College, Fort Leavenworth, Kans.

MCCORMACK, TERENCE KEVIN (Jun. '47) 27 North Grand Ave., Baldwin, N.Y.

MCGAW, JOHN MCNEE (Assoc. M. '47) Civ. Eng. Asst., Burgh Engr's. Dept., 14 Gilmour St., Paisley (Res., 52 Balshagray Ave., Glasgow, W.I.), Scotland.

MEARA, FRANCIS LEO (M. '47) Director, U.S. Concrete and Soils Laboratory, Corps of Engrs., U.S. Concrete and Soils Laboratory, Tower Road, Ithaca, N.Y.

MIKLOFSKY, HARREN ALBERT (Jun. '47) Graduate Student, Yale University, New Haven (Res., 15 Middle Rd., Hamden), Conn.

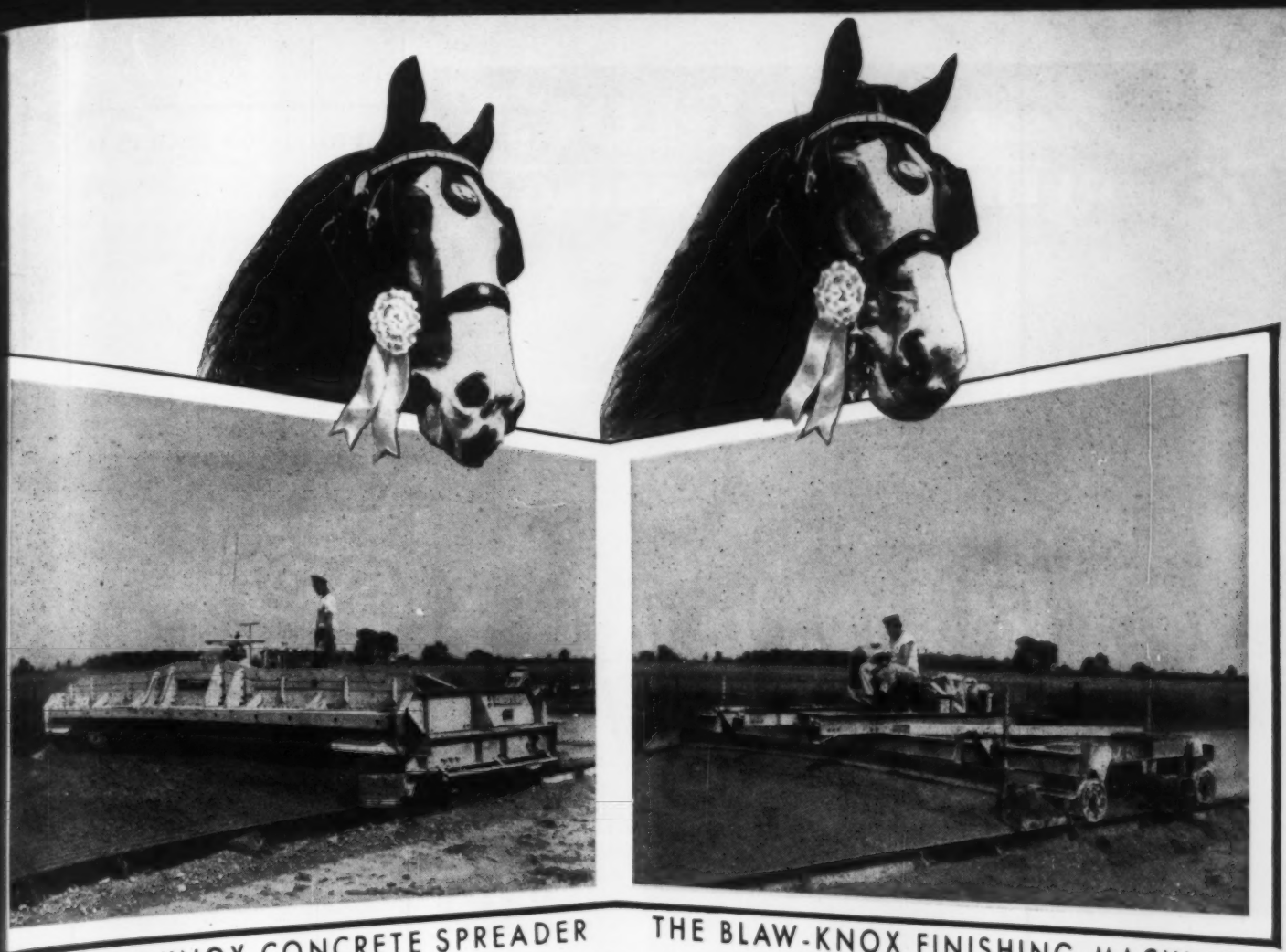
MOYER, RALPH DAVID (M. '46) Cons. Engr. (independent oil interests), Guatemala and Nicaragua (Res., Dunbar, Pa.).

NELSON, JOHN EARL (M. '47) City Bldg. Insp., City of Minneapolis, 213 City Hall, Minneapolis, Minn.

NEMETH, BLASE (M. '47) Executive Officer, Corps of Engrs., 575 Riverside Ave. (Res., 4215 Pinewood Ave.), Jacksonville, Fla.

NEWLIN, PHILIP BLAINE (Jun. '47) Instr. in Civ. Eng., Univ. of Arizona (Res., Box 4533 Univ. Station), Tucson, Ariz.

NICHOLS, PAUL RAINEY (Assoc. M. '47) Constr. Supt., Moss-Thornton Co., Inc., 1908½ Second Ave., South, Birmingham (Res., Box 87, Crossville), Ala.



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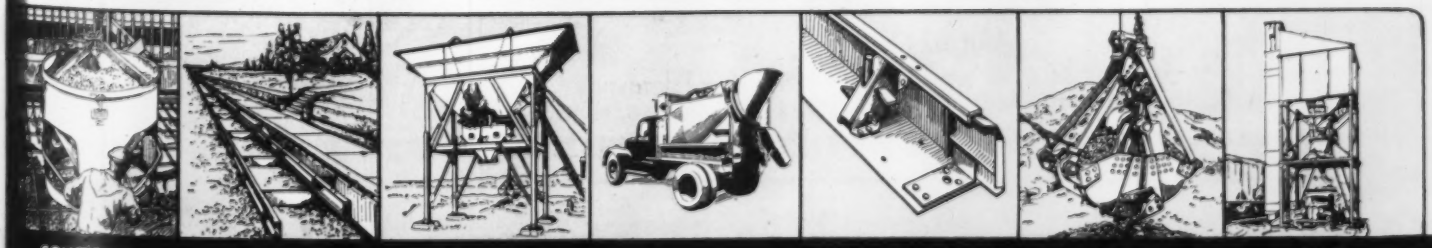

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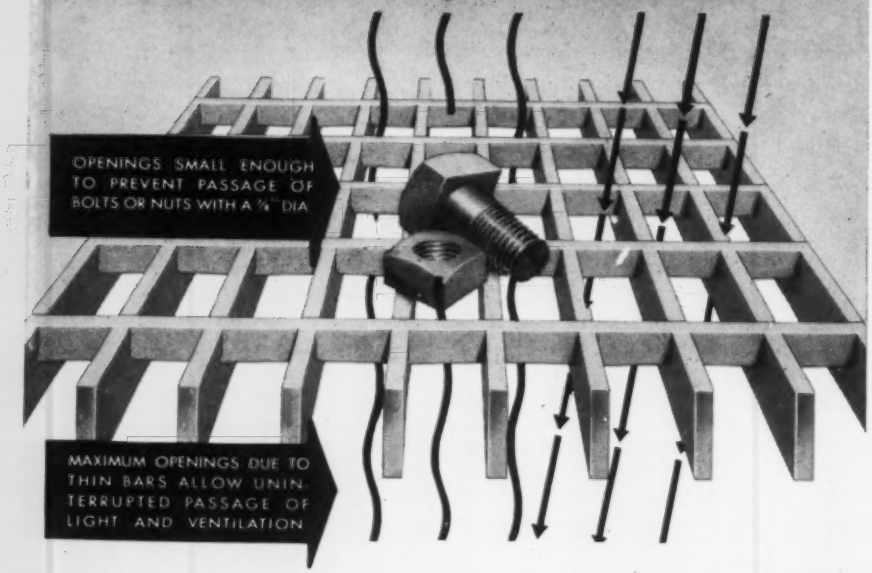
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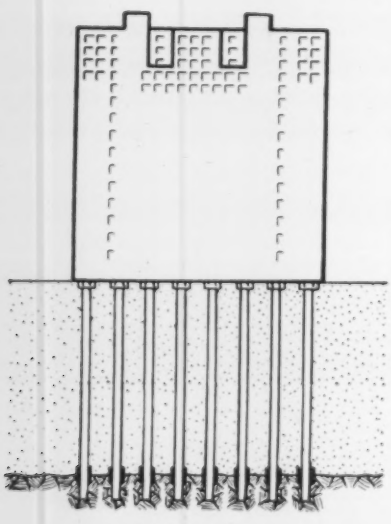

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Members	6,602
Associate Members	8,553
Corporate Members	15,155
Honorary Members	39
Juniors	6,471
Affiliates	75
Fellows	1
Total	21,741
(May 9, 1946	21,350)

OJALVO, MORRIS (Jun. '47) Tutor, College of the City of N.Y., 137th St. & Convent Ave. (Res., 2308 Twenty-fourth Ave.), New York 2, N.Y.

OMACHI, HENRY TAKASHI (Jun. '47) 1st Lt., Infantry, A.U.S. AG-GHQ-FEC, CAS. Sec., Army Post Office 500, Care, Postmaster, San Francisco, Calif.

OSBORN, WILLIAM BLAND (Jun. '47) Apprentice Bridge Engr., Atchison, Topeka & Santa Fe Ry. Co., A.T.S.F. Steel Bridge Force 1, Amarillo, Tex. (Res., 418 South Fifth St., Geneva, Ill.)

PALMER, JOHN ELLIOTT GEORGE (M. '47) (Rendel Palmer & Tritton), 55 Broadway, Westminster, London, England.

PRIDDLE, RAYMOND ARTHUR (Assoc. M. '47) (MacDonald, Wagner & Priddle), 350 George St., Sydney, Australia.

PURVIS, VIRGIL OTHO, JR. (Assoc. M. '47) Associate Engr., Marion L. Crist & Associates, 508 Union Life Bldg. (Res., 405 South Oak St.), Little Rock, Ark.

RANEY, CARROLL STANLEY (Jun. '46) Asst. Constr. Supt., Warner Constr. Co., Chicago (Res., 1009 West Pennsylvania, Urbana), Ill.

REED, CARROLL SHERMAN (Jun. '47) Director, Technical Div., Metal Lath Manufacturers Assn., 636 Engrs. Bldg., Cleveland 14, Ohio.

REED, RICHARD LAW (Jun. '47) Asst. Engr., Worden-Allen Co., 4100 North 3d St. (Res., 536 North 15th St.), Milwaukee 3, Wis.

ROBBINS, DANIEL MAURICE (Assoc. M. '47) Structural Archt., War Dept., U.S. Engrs., Faidly Bldg. (Res., 4548 Walnut St.), Omaha 5, Nebr.

ROBINSON, WILLIAM KIRLEY (Jun. '46) Electronic Technician Mate, 2/C, U.S. Navy 620 South Stewart St., Winchester, Va.

SANDERS, IRA TAYLOR (M. '47) Lt. Comdr., U.S. Coast & Geodetic Survey, U.S. Dept. of Commerce, 602 Federal Office Bldg., 90 Church St., New York 7, N.Y.

SARMIENTO, JORGE FERNANDO (Jun. '46) Lt., Peruvian Army, Corps of Engrs., Cia Pontoneros No. 1, La Huaca, Piura (Res., Apartado 3080, Miraflores, Lima), Peru, S.A.

SCHULTZ, EDWARD AUGUST (Assoc. M. '46) Engr., Panama Canal Special Eng. Div., Diablo Heights, Canal Zone.

SEERY, ROBERT FRANCIS (Jun. '47) with Strickler Mfg. Co., 815 North Larrabee St., Chicago (Res., 739 Duane St., Glen Ellyn), Ill.

SENN, CHARLES LESTER (Assoc. M. '46) Senior Public Health Engr., Director Sanitation Bureau, Los Angeles City Health Dept., 116 Temple St., Los Angeles 12, Calif.

SHURLDS, ALBERT MAURY (Jun. '47) Teacher, Vaiden Consolidated School, Box 69, Vaiden (Res., Box 366, Tchula), Miss.

SKOW, FLOYD ARTHUR (Assoc. M. '47) Sales Engr., Economy Form Corp., P.O. Box 658 (Res., 2245 Hiawatha Blvd.), Ft. Wayne, Ind.

SMALL, FRANK AUGUSTUS, JR. (Assoc. M. '47) Res. Engr., State Highway Comm. (Res., P.O. Box 241), Bozeman, Mont.

SMYSER, RUDOLPH ETHELBERT, JR. (M. '47) Col., Corps of Engrs., U.S. Army, Dist. Engr., St. Louis Dist., War Dept., 826 Federal Bldg. (Res., 1446 Rankin Drive, Richmond Heights), St. Louis 17, Mo.

STAATS, HENRY RYAN (Assoc. M. '47) Director, Civil Engineering Service, Inc., 2626 South East Ankeny St., Portland 15, Ore.

STANFORD, PAT HARRIS (Jun. '47) (The Avery-Stanford Co.), 313 North Colorado, Drawer 952, Midland, Tex.

TALLEY, GLENN WESLEY (Jun. '47) Engr., P-2, Corps of Engrs., War Dept., P.O. Box 61 (Res., 250 South Richmond), Tulsa, Okla.

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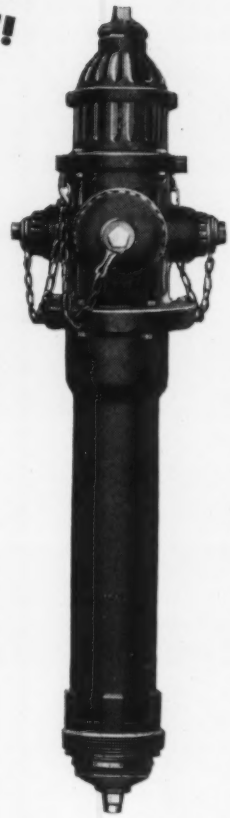

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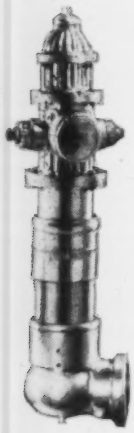

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TOOLES, CALVIN WARREN (Jun. '46) Instr. in Mech. Eng., Univ. of Vermont (Res., 234 Pearl St.), Burlington, Vt.

TROTTER, ROBERT MICHAEL (M. '47) Asst. Gen. Mgr., Great Lakes Dredge & Dock Co., Rm. 1125, 122 South Michigan Ave., Chicago 3, Ill.

URBINA, MARIO (Jun. '46) Job Engr., Martin Eng. Co., Box 370, Maracaibo, Venezuela.

WALTER, GEORGE WINTON (Jun. '47) Supervisor, Steel Detailing, Ward-Cramer, 626 Broadway, Cincinnati, Ohio. (Res., 507 Wallace, Covington, Ky.)

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WHITE, ARDIS HOWARD (Jun. '47) Instructor in Civ. Eng., Southern Methodist Univ. (Res., 419 North Tennant St.), Dallas 11, Tex.

WHITE, ROBERT PATTON (M. '47) Park Engr. (Civ.), Interior Dept., U.S. National Park Service, Gatlinburg, Tenn.

WILSON, WALTER BROWNLEE, JR. (Jun. '46) Instr., Civ. Eng. Dept., Virginia Military Inst., Lexington, Va.

WOLFF, GEORGE EDWARD (Jun. '46) Civ. Engr., Tennessee Valley Authority, 415 Union Bldg. (Res., Care, Hackworth, Route 1), Knoxville, Tenn.

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DOUGHERTY, JOHN WILSON (Jun. '34; Assoc. M. '47) Senior Engr., Bechtel Corp., 4620 Seville Ave., Vernon (Res., 10340 Dorothy Ave., South Gate), Calif.

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GILMAN, GEORGE THOMAS (Assoc. M. '29; M. '47) (Moran, Proctor, Freeman & Mueser), 420 Lexington Ave., New York 17, N.Y.

GREEN, WILLIAM WELLS (Jun. '41; Assoc. M. '47) Office Engr., Blucher Eng. Co., 1111 North Mesquite St. (Res., 3149 Topeka St.), Corpus Christi, Tex.

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KENISTON, FRANK MERTON (Jun. '36; Assoc. M. '47) Job Supt., U.S. Bureau of Reclamation (Res., North Dorm), Coulee Dam, Wash.

KOCHTITZKY, OSCAR WILBUR, JR. (Jun. '32; Assoc. M. '47) San. Engr., Tennessee Valley Authority, 306 McNutt Bldg., Knoxville, Tenn.

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LONG, WILLIAM FREDERICK (Jun. '39; Assoc. M. '47) Soil Conservationist (Eng.), Soil Conservation Service, 420 Stapleton Bldg., Billings, Mont.

MARTIN, WILLIAM COURTNEY (Jun. '39; Assoc. M. '47) Project Engr. (Bridge Const.), State Highway Comm. of Ind., State House Annex, Indianapolis (Res., 1217 Fourteenth St. Bedford), Ind.

MITCHELL, WILLIAM HENRY (Jun. '40; Assoc. M. '47) Engr., Structural Div., Stone and Webster Eng. Corp., 49 Federal St., Boston (Res., 10 Florence St., Wollaston 70), Mass.

MORTENSEN, CLIFFORD NELSE (Jun. '33; Assoc. M. '47) (Nelse, Mortensen & Co.), 1021 Westlake North, Seattle 9, Wash.

PULLY, ROBERT VINSON (Jun. '41; Assoc. M. '47) Engr., War Assets Administration, Box 6030 (Res., 4403 Gaston Ave., Apt. 12), Dallas 4, Tex.

RAPHAEL, JEROME MAURICE (Jun. '36; Assoc. M. '47) Engr., U.S. Bureau of Reclamation, Denver 2, Colo.

SAUER, ARTHUR ALVERT (Assoc. M. '29; M. '47) Cons. Structural Engr., 620½ Eye St., Sacramento, Calif.

SCROGGIE, EVERETT (Assoc. M. '34; M. '47) Senior Structural Engr., Tennessee Valley Authority, Knoxville, Tenn.

SELLNER, EDWARD PIUS (Jun. '37; Assoc. M. '47) Asst. Prof. of San Eng., Kansas Univ., Rm. 2, Marvin Hall, Lawrence, Kans.

SMELSER, PAUL EDWARD (Jun. '34; Assoc. M. '46) Hydr. Engr., U.S. Engr. Dept. (Res., 10 Hulbert St.), Mobile, Ala.

SWEET, JAMES SIMEON (Assoc. M. '40; M. '47) Regional Hydrologic Engr., U.S. Weather Bureau, 383 Madison Ave., New York (Res., 244-11 Thornhill Ave., Douglaston), N.Y.

SWEENEY, RALPH CRISSMAN (Assoc. M. '29; M. '47) Dist. San. Engr., State Health Dept., 34 South St., Middletown, N.Y.

SWENDSEN, WARREN GIBBS (Assoc. M. '10; M. '47) Pres. & Gen. Mgr., Intermountain Equipment Co., Box 1997, Boise, Idaho.

THOMAS, HENRY HARDSTAFF (Jun. '39; Assoc. M. '47) Principal Asst. Civ. Engr., The Hydro Electric Comm., Hobart, Tasmania, Australia.

VERA-SANCHEZ, JUSTO GENTIL (Jun. '44; Assoc. M. '46) Engr., Alosoco Limitada, Apartado postal 13-93, Apartado Aereo 35-98, Bogota, Colombia, S.A.

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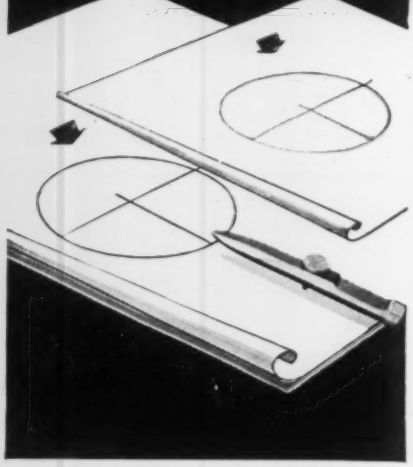

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BURLEIGH, HARRY PAUL, Assoc. M., Engr., U.S. Bureau of Reclamation, Carlsbad, N.Mex., reinstated April 23, 1947.

FERNS, JOHN HAMILTON, Assoc. M., Associate Engr., State Dept. of Finance, 815 Capitol Ave. (Res., 1816 Fifth Ave.), Sacramento, Calif., readmitted Nov. 18, 1946.

HAMMERSMITH, ROBERT CHARLES, Assoc. M., Senior Engr., Kaiser Engineers, Inc., 1924 Broadway (Res., 3000 Parker Ave.), Oakland 5, Calif., readmitted March 12, 1947.

HEAVEY, WILLIAM FRANCIS, M., Dist. Engr., New York Dist., U.S. Engrs., 120 Wall St., New York 5, N.Y., reinstated Apr. 22, 1947.

JACKSON, ROBERT GEORGE, Assoc. M., Group Leader, Equipment Div., E. B. Badger & Sons Co., 75 Pitts St., Boston (Res., 334 Crescent St., Waltham), Mass., reinstated Apr. 28, 1947.

JOINER, JAMES ROBERT, Jun., 2816 Amherst, Dallas, Tex., reinstated Apr. 14, 1947.

KURTTILA, GEORGE HENRY, Assoc. M., Senior Engr., Corps of Engrs., Seattle Dist., War Dept., 1400 Textile Tower, Seattle (Res., Route 2, Box 156, Bothell), Wash., readmitted Apr. 14, 1947.

LIGHT, WILLIAM CRAIG, Jun., 801 Baseline, Boulder, Colo., reinstated Apr. 22, 1947.

MARTIN, FRANK LYSANDER, Assoc. M., Prof. of Civ. Eng., Pennsylvania Military College (Res., 143 Parkway Ave.) Chester, Pa., reinstated Apr. 22, 1947.

MATTHEWS, JAMES FREDERICK, M., Valuation Engr., 307 Washington St., Brooklyn, N.Y., reinstated Apr. 14, 1947.

MILLER, JOHN ANDERSON, M., Special Writer, General Electric Co. (Res., 27 Front St.), Schenectady, N.Y., reinstated Apr. 22, 1947.

PHANEUF, VICTOR SIMEON, M., Engr. (Hersey & Phaneuf) (Res., Davis Road), Durham, N.H., reinstated Apr. 17, 1947.

PHILLIPICH, ANTHONY RAYMOND, Jun., with Bridge Design Office, State Highway Dept., Lansing 13, Mich. (Res., Box 266, Elcor, Minn.), reinstated April 15, 1947.

RUSSELL, TOM, Assoc. M., Senior Eng., City Eng. Dept. (Res., 1700 South Paxton St.), Sioux City 20, Iowa, reinstated Apr. 22, 1947.

WILLIAMS, THOMAS WILLIAM, Assoc. M., Engr., City of New Bedford, 415 County St., New Bedford, Mass., reinstated Apr. 14, 1947.

Resignations

BECKSTEAD, MAURICE WEBSTER, Jun., Route 1, Box 80, Gustine, Calif., resigned Apr. 23, 1947.

BOYARIN, DAVID, Jun., R.F.D. 1, Farmingdale, N.J., resigned Apr. 7, 1947.

BURTON, GEORGE WILLIAM, Jun., 267 North Ridge Road, San Francisco 24, Calif., resigned Apr. 15, 1947.

CAMPBELL, WILLIAM JOSEPH, Jun., 10123 St. Martha Lane, Overland 14, Mo., resigned Apr. 7, 1947.

CASEY, JOHN JAMES, M., 538 Dewey Blvd., San Francisco, Calif., resigned Dec. 31, 1946.

HOLMAN, JOHN ADAM, Jun., 226 East Franklin St., Anderson, S.C., resigned Apr. 14, 1947.

JOHNSON, GEORGE PETER, Assoc. M., 533 North Hoover St., Whittier, Calif., resigned Apr. 24, 1947.

KASS, HERBERT, Jun., 508 West 178th St., New York 33, N.Y., resigned Apr. 3, 1947.

KLINE, WENDELL LEON, Jun., Box 149, Ponca City, Okla., resigned Dec. 30, 1946.

LINCER, MAXWELL, Jun., 286 Hewes St., Brooklyn 1, N.Y., resigned Apr. 2, 1947.

NIDAY, LLOYD EDWARD, Jun., R.D. 2, Box 48, Bidwell, Ohio, resigned Apr. 7, 1947.

PURINGTON, DONALD VARNEY, Assoc. M., Care, Chamber of Commerce, Gilmor, Tex., resigned Apr. 2, 1947.

SHNAPER, ROBERT, Jun., 84 Hazelton St., Mattapan 26, Mass., resigned Apr. 14, 1947.

SOULE, EDWARD LEE, Assoc. M., 1750 Army St., San Francisco, Calif., resigned Apr. 15, 1947.

SPROUT, DEANE ORLAND, Jun., 1220 Cook St., Denver 6, Colo., resigned Apr. 19, 1947.

WARRINGTON, JOHN BURWELL, JR., Jun., C-12 Garden Drive, Roselle, N.J., resigned Apr. 24, 1947.

WESTERFELD, STUART CLARENCE, Assoc. M., 4736 North Berkeley Blvd., Milwaukee 11, Wis., resigned Apr. 17, 1947.

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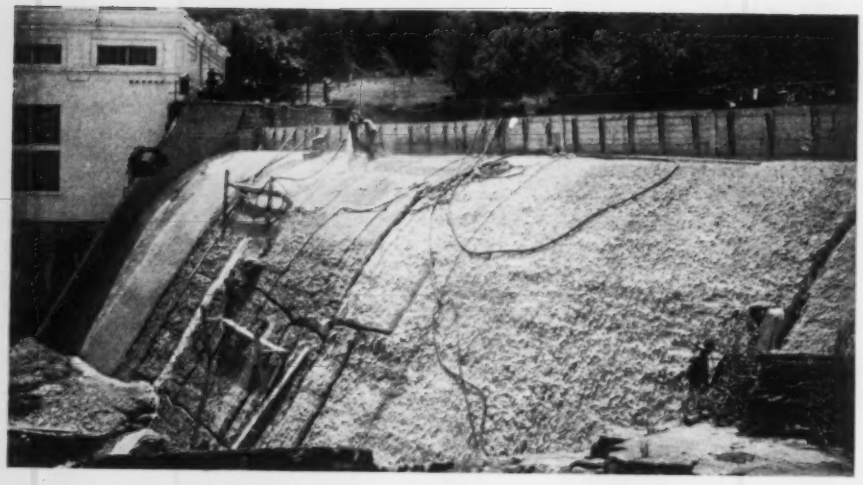

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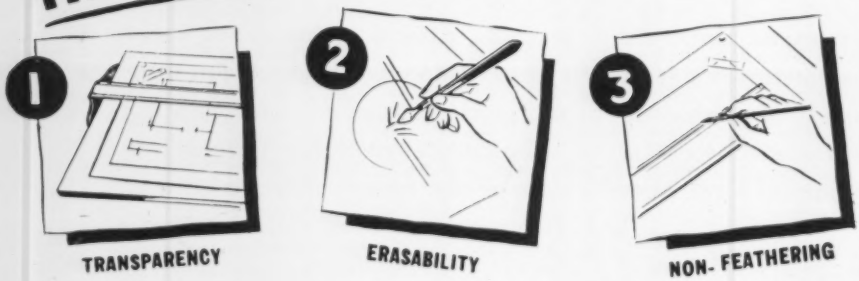

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(*Continued from page 84*)

RESISTANCE OF MATERIALS, 3 ed. By F. B. Seely. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 486 pp., illus., diagrs., charts, tables, 8½×5½ in., cloth, $4. Part I of this standard text is concerned with the generalized basic aspects of the subject, the main problem being the determination of the relationships between the loads acting on a member and the resulting stresses and deformations in the member. Part II deals with more specialized topics such as particular kinds of stresses or structural members which may be dealt with independently. The emphasis throughout is on the engineering significance of the subject, with consideration given to altered conditions resulting from recent technological developments.

ROADWAY AND TRACK. By W. F. Rench. Simmons-Boardman Publishing Corp., New York, 1946. 350 pp., illus., diagrs. tables, 9¼×6 in., cloth, $5. Modern methods of roadway and track maintenance are described and illustrated in the new edition of this standard practical handbook. While the utilization of mechanical equipment is featured, methods in use where such equipment is not available are also covered. Part III, which is on special problems and duties, includes the economics of track labor, safety precautions, and the investigation of train accidents.

SPEEDING FLOODS TO THE SEA. By W. E. Elam. Hobson Book Press, New York City (52 Vanderbilt Avenue), 1946. 173 pp., illus., diagrs., charts, 9×6 in., cloth, $3.50. Subtitled "The Evolution of Flood Control Engineering on the Mississippi River," this book graphically presents the story behind the Mississippi River cutoffs. The author, an early advocate of the cutoff plan, also outlines a new and comprehensive plan of flood control, covering not only the Mississippi but applicable also to flood problems on other comparable streams.

STEAM POWER STATIONS, 3 ed. By G. A. Gaffery. McGraw-Hill Book Co., New York and London, 1946. 613 pp., illus., diagrs., charts, tables, 9×6 in., cloth $5.50. Steam power plant machinery is covered from the standpoint of construction of the various types of equipment, their performance characteristics, economics, and integration in the complete plant. The new edition of this standard textbook has been revised, and includes recent information on modern equipment, such as steam turbines, condensing equipment, steam-generating units, and mercury-steam installations. The material has been strictly confined to the mechanical-engineering features, with emphasis on design and construction.

TIMBER DRYING AND THE BEHAVIOUR OF SEASONED TIMBER IN USE, 2 ed. By R. G. Bateson. Crosby Lockwood & Son, London, 1946. 129 pp., illus., diagrs., charts, tables, 8½×5½ in., cloth, 10s.6d. The principles of timber drying are explained and methods and equipment for both air-seasoning and kiln-seasoning are described in practical detail. Specific problems are discussed with their solutions, and one chapter is devoted to the behavior of seasoned timber in use.

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA, 2 ed. D. Van Nostrand Company, New York, 1947. 1600 pp., illus., diagrs., charts, tables, maps, 10½×7 in., cloth, $10. Considerably revised, this comprehensive reference work presents in detail over 10,000 separate subjects, dealing with the principles and applications of the physical sciences, medicine, and technology, from aeronautics to zoology. The presentation of each topic is geared to the general reader. In addition to the customary cross references, all terms in the main alphabetical list are printed in heavy type wherever they appear in the context. Diagrams, sketches, and data tables are included wherever they will be of particular use.

WRITING SCIENTIFIC PAPERS AND REPORTS. By W. Paul Jones. William C. Brown Co., Dubuque, Iowa, 115 pp., 11×8 in., cloth, $2.50. This comprehensive text was prepared for use in a course on the writing of scientific papers and reports for juniors and seniors at Iowa State College. The intention of the author has been to confront students with a number of simple problems in scientific exposition, and give them instruction and practice in organizing ideas and communicating them to the reader. Two chapters are devoted to the mechanics of expression.

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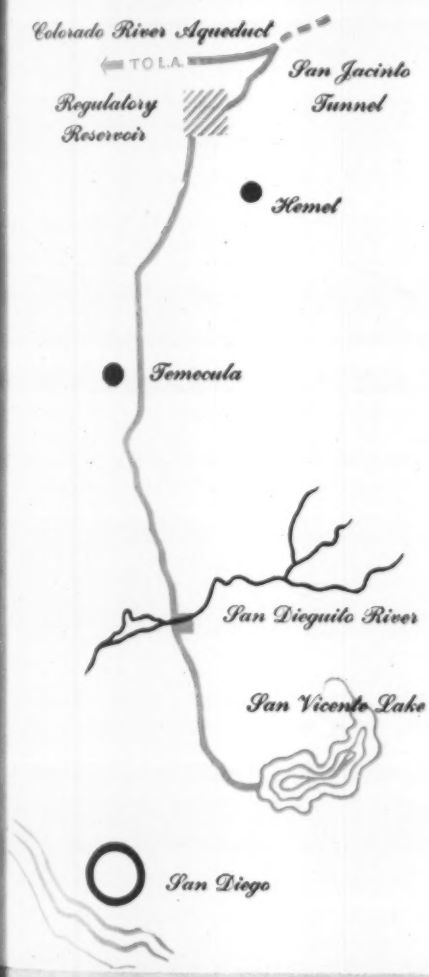
Fabricating reinforcement cages for steel bands in left foreground.

ANOTHER MILESTONE IN WATER SUPPLY LINE CONSTRUCTION



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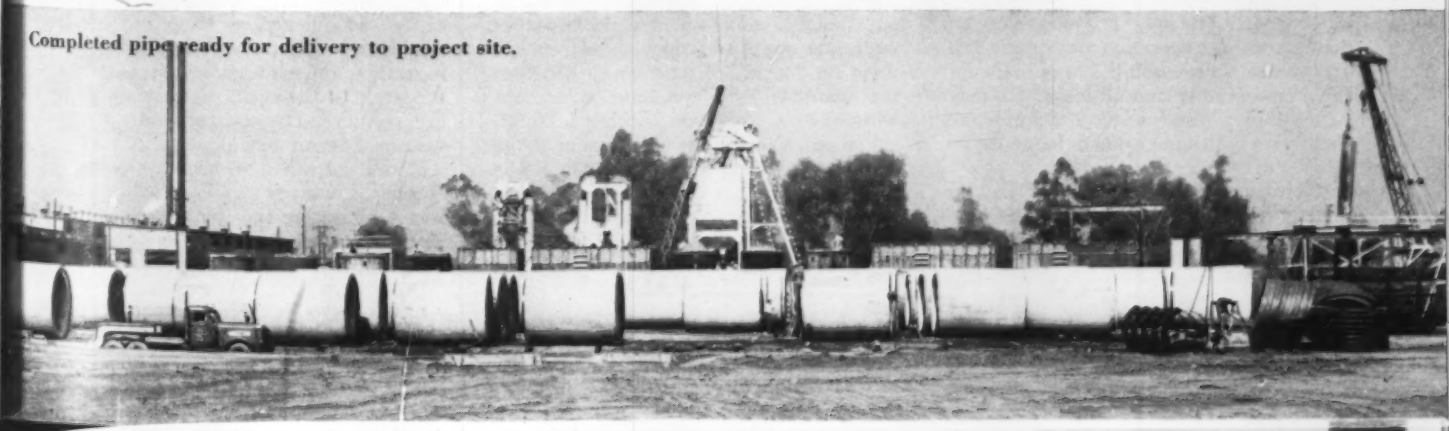


Completed pipe ready for delivery to project site.

Equipment, Materials and Methods

New Developments of Interest, as Reported by Manufacturers

Paving Breaker

A NEW PAVING BREAKER, the PB-8, has been announced by Ingersoll-Rand. This new 82-lb machine is suitable for heavy-duty demolition work and general paving breaking jobs. The new kicker-port valve used in the PB-8 greatly increases the efficiency and striking power of the machine. Oil economy is assured by a metering device that furnishes proper lubrication for all working parts. An adequate oil reserve is provided by a generous size oil reservoir in the handle. A rigid joint between the handle and cylinder is the result of four bolt construction. Reverse buttress threads on the fronthead bolts provide sufficient tightness without overstressing the bolts. An improved throttle valve allows the gradual entrance of air and permits easier and smoother starting.

Other features are a sturdy block type piston, long anvil-block bearing and a longer handle.

In addition, the PB-8 Paving Breaker may very easily be converted into a pile driver or spike driver by simply changing fronthead. This feature enables the breaker to do the work of three different machines.

For additional information, write Ingersoll-Rand, 11 Broadway, New York 4, N. Y. or any of its many branch offices. Ask for Bulletin No. 4051.

New Precision Hook Gage

THE NEW "Dwyer Transparent Hook Gage" is now being offered to industry. This instrument is said to exceed in accuracy any in its class yet invented.

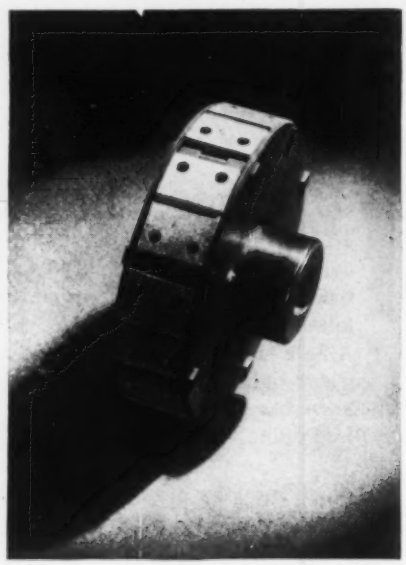
The new device works on the simple principles of the U-type water column gage. The difficulty encountered in ordinary gages of this type—that of capillary pull on the water columns—has been overcome by widening the columns to $2^1/_2$ in., thus rendering the pull ineffective, especially since the measurements are taken from the center of the column. This is done by needle-pointed "hooks" which are attached to depth micrometers of a standard make, reading accurately down to one-half of one-thousandth of an inch, over a range of 0 to 2 in.

With the exception of the hooks and micrometers, the entire gage is made of an unbreakable, transparent plastic, with no moving parts. It may thus be read easily, and its complete operation may be checked at a glance. Provision has been made for rapid disassembly and cleaning. It may be used anywhere that a steady pressure within its scale range must be correctly measured.

Complete information may be had by mailing requests to the F. W. Dwyer Mfg. Co., 317 South Western Ave., Chicago, Ill.

Mercury Clutch

A MERCURY-ACTUATED clutch developed by Mercury Clutch Corp. of Canton, Ohio, makes possible automatic starting of air compressors. The clutch permits the driving motor to attain full speed before the compressor turns, eliminating the need for pressure release valves. This automatic clutch incorporates a "time delay" factor which retards the engagement for a second or more, long enough to permit the motor to come up to full speed before any load is applied. The motor is



MERCURY CLUTCH ROTOR ASSEMBLY designed for use on the Worthington Air King Compressor. The friction shoes engage the inner surface of the flywheel. The actuating force is generated by a small quantity of mercury sealed with the clutch itself. Under rotation, this builds up a hydraulic pressure which is applied directly to the friction shoes, the force varying as the square of the rotational speed.

then able to bring to bear its greatest torque plus the inertia of its rotor to start the load. Motor current is greatly reduced and the starting windings are protected. Mercury (Quicksilver) is used as the control medium because of its high specific gravity. Centrifugal force acting on a small amount of mercury produces hydraulic pressure which is dependent upon the "head" of mercury rather than the amount. This pressure is utilized without the use of levers or other mechanical means, to cause the engagement of the fraction elements of the clutch. The manufacturer has developed standard clutches for all types of electric motors up to 15 h.p., and for internal combustion engines.

Concrete Vibrating Machine

THE VIBER SLAB, a multiple high-speed internal vibrating machine has been developed and used most successfully for the positive compaction of concrete in large masses. Higher quality concrete with substantial savings in time, labor, construction and maintenance costs have resulted from its use. It is designed for continuous full width, full depth compaction of slabs up to 25 feet. It requires but a single operator and may be attached to most types of spreading and finishing equipment. The Viber Slab uniformly compacts the stiffest concrete mix on slabs as fast as it can be placed, the entire depth being vibrated, not just the surface. Unusual slab strength is produced economically by the consistent compaction of the Viber Slab.

A New Conveyor Belt

A NEW CONVEYOR belt, 250 to 400 percent stronger than previous rubber-fabric belts has been developed by United States Rubber Company for conveying coal, iron ore and other bulky materials over long distances. It is announced by W. H. Cobb, vice-president of the Company.

The key to increased strength is a revolutionary new textile construction of nylon and Ustex yarn that increases the permissible working tension of each ply two and one-half times and permits the use of more plies.

The new product is especially designed for use in mines, quarries, and large dam construction projects. It should save industry many thousands of dollars annually through lower maintenance costs and improved efficiency of material handling equipment. It carries heavier loads than other rubber-fabric belts and will extend the range of conveyors. It eliminates many costly transfer points and extra driving mechanisms.

In addition to greater strength, the new belt has the advantages of low stretch lengthwise and increased flexibility crosswise. These two features make it possible to build a longer and heavier belt with a minimum of stretch and excellent troughing qualities. More than twice as many plies can be used. The belt can be spliced easily and quickly, an important consideration in installations where it is delivered in sections and made endless at the operating site. In the event of accidental damage, repairs can be made promptly by conventional repair techniques.

Ustex yarn is a development of U.S. Rubber Company textile scientists. It was used during the war to make Army parachute harness and the new belt is its most important postwar application.

New Anti-Corrosive Process

"ZINCILATE," an anti-corrosive process which affords 20 years protection to ferrous metals against all common corrosive forces, has been announced by Industrial Metal Protectives, Inc., Dayton, Ohio.

"Zincilate" has been used successfully on pipelines; on the interiors and exteriors of water and gasoline tanks and bridges; on machine parts, and on marine installations where it affords not only anti-corrosive but also anti-fouling service.

"Zincilate" is a "one coat" protective coating. It posseses remarkable abrasion resistance. Even when sizable areas are destroyed by unusual scraping or wear, lasting protection is assured through cathodic sacrifice of the film. An affiliated company, Industrial Metal Protectives Corporation of Virginia, Newport News, Virginia, will be the initial producers of this anti-corrosive product, but additional manufacturing and treatment plants are contemplated. The initial commercial production of "Zincilate" has begun and quantities are available for distribution.

New Versatile Fluid Motor

FOR THOSE REQUIRING rotary power with controlled variable speed, and particularly where shock-loads present problems for conventional motors, the announcement of a radically new Fluid Motor, by the Denison Engineering Co., Columbus, Ohio, will be of interest. This new Fluid Motor of axial piston design is available in a 3 hp and 5 hp capacity; with or without a speed control valve; with or without a choice of geared-head units of various gear ratios; and with a selection of brackets for mounting the motor with equal operating efficiency in any position desired.

The motor features an exclusive "Floating Drive," wherein constant pressure contact is maintained between the driving and driven elements without the use of mechanical linkages or connecting rods of any kind. It is said that this eliminates the destructive effects of backlash or inertia resulting from sudden starts, stops, and reversals. The motor is fully self-starting; operates equally efficient in either direction can be instantaneously reversed, and is completely self-lubricating.

When equipped with the speed-control valve this Fluid Motor can be pre-set to operate at any speed within its capacity. Infinite speed variations are obtained by the adjustment of a knurled knob on the side of the valve. A plunger device interlocked with the speed-control valve permits instant acceleration from any pre-set speed to full speed whenever desired. When plunger is released, the motor returns at once to its pre-set speed.

Other features reported on this motor are: simplified design, with number of working parts reduced to a minimum; extra rugged construction; use of standard commercial-type ball-bearings; provision for economical maintenance; and extremely moderate in price. For complete specifications on this new Fluid Motor write The Denison Engineering Co., Columbus 16, Ohio.

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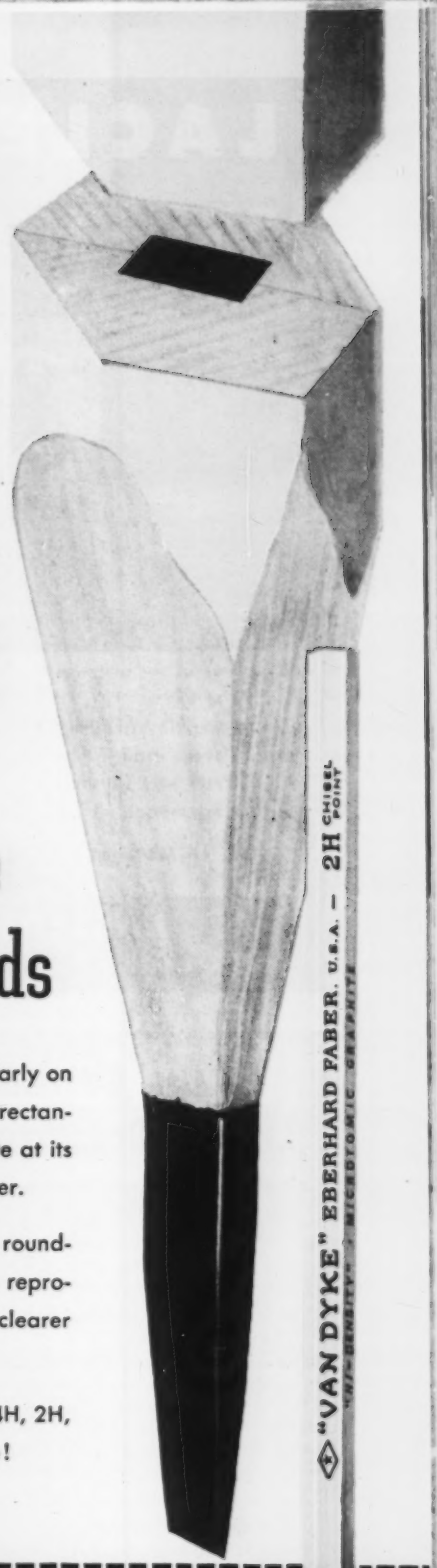

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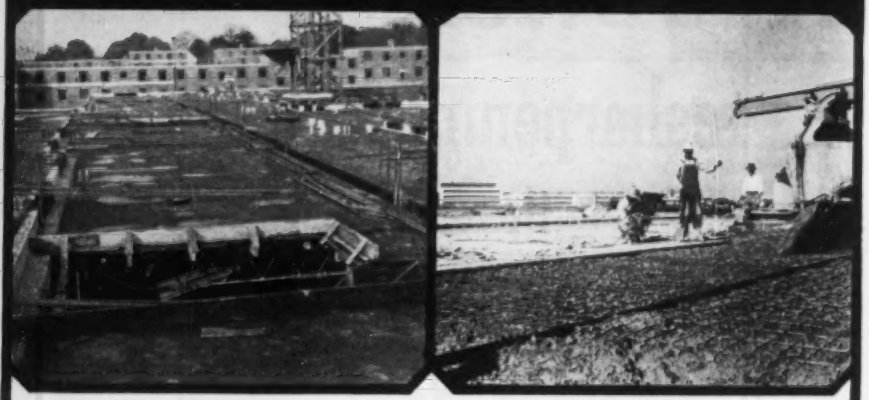

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New Framing Anchor

A NEW TIMBER connector, known as a framing anchor, used to increase rigidity around window and door openings and as added strength in floor and wall framing is meeting with wide-spread approval by architects and engineers, according to the Timber Engineering Company.

Made of 18-gage zinc-coated, corrosion resistant sheet steel, the anchors are joined to the wood with non-splitting full bodied nails that develop maximum shear without splitting the lumber.

Known as Trip-L-Grip framing anchors, the devices have been laboratory tested at Georgia Tech and are now specified in joining joists to beams, beams to posts, studs to sills, rafters to plates, studs to girts and other house framing connections. They develop both shear and tension. Costs are reduced through eliminating presently used cumbersome and expensive methods and less materials are required.

Toe nailing uncertainties are replaced, bridging is eliminated in attaching joists on trusses and notching is unnecessary.

Like all basically sound units, they are of the utmost simplicity. If connections are at angles, flanges can be bent accordingly. In addition to home construction, anchors are also used in farm buildings, prefabricated housing, timber trusses, form work, scaffolding, platforms, jigs and templates. For further information write the Timber Engineering Company, 1319 Eighteenth Street, N.W., Washington 6, D.C.

New Line of Sewage Pumps

A NEW LINE of Worthington "dry pit" centrifugal pumps has been introduced by Worthington Pump & Machinery Corporation, Harrison, N. J. The line consists of seven sizes for each of three types, covering complete range of requirements. Designs have been standardized for maximum interchangeability of parts.

Features of this line include the following: renewable shaft sleeve, heavy-duty ball bearings, positive grease lubrication, non-clogging impeller, and rugged casing.

Line drawings, scaled $\frac{3}{8}$ in. to 1 in. suitable for tracing in plans, are available to consulting engineers upon request. Descriptive bulletin W-317-B10 is also available.

Low-Hydrogen Electrode

A NEW ELECTRODE which simplifies the welding of high sulfur, free-machining sheet and of certain high-tensile, low-alloy steels, is announced by The Lincoln Electric Co., Cleveland, Ohio.

The new Lincoln Electric electrode, known as "Shield-Arc LH-70," has a low-hydrogen, low-moisture coating and is designed for use with d.-c. polarity, as the welded tensile properties are 70,000–80,000 tensile strength and elongation is 25 to 30 percent. Welding currents used are high in comparison with other all-position-type electrodes. The range is: $\frac{1}{8}$ in., 100 to 135 amperes; $\frac{5}{32}$ in., 140 to 190 amperes; and $\frac{3}{16}$ in., 180 to 250 amperes. A rather short arc is recommended.

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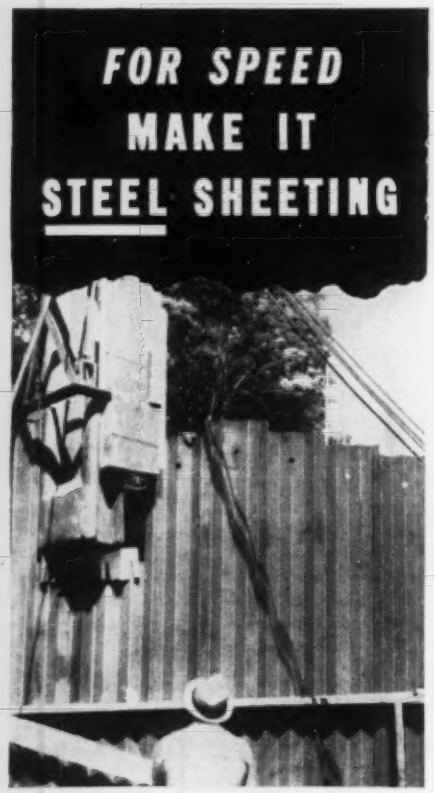

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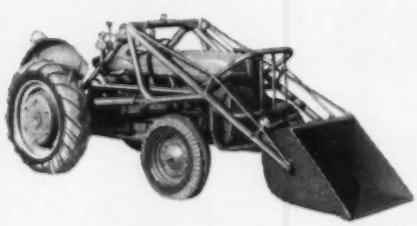
The LOADTRAC is mounted to the tractor in front by the installation of a special axle hinge pin to which the front of the loader is attached. In this manner, weight is placed directly from the loader to the axle as well as maintaining alignment between the pump and crankshaft. The LOADTRAC is of tubular all-welded construction, and no bolts or assembly is required. The original installation of a special heavy fan sheave and axle hinge pin is made in an hour, after which the LOADTRAC may be installed or dismounted in 10 minutes. Various attachments which include material bucket, manure fork, industrial crane, industrial lift-fork, bulldozer, sweep-rake, snow plow, and coal bucket are available as additional attachments.



Three-Cu. Ft. Kinetic Mixer

THE FOOTE KINETIC MIXER, a portable 3-cu. ft. machine employing a radically new mixing principle, has been announced by The Foote Co., Inc., Nunda, N.Y. This mixer is designed to handle all types of cold asphaltic mixes, including sheet asphalt and asphaltic concrete. It is claimed that the new mixing principle provides a thorough coating of all aggregate particles with asphalt, making possible for the first time in a small mixer the completely successful use of chemical additives to eliminate the need for drying wet aggregates. In addition to its use

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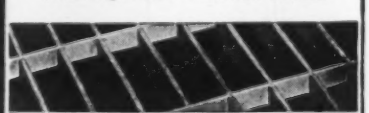

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for patching and paving asphalt areas, the mixer has been successfully employed on asphaltic floor emulsions, sand, chemicals, concrete, and other construction and industrial mixes.

Capacity of the Foote Kinetic Mixer under good conditions is as high as two batches per minute. The operating cycle at this speed is 5 sec for charging from a wheelbarrow, 20 sec for mixing, and 5 sec for discharging by a hand-controlled chute at the top of the machine.

The mixing action which permits this high output is accomplished by a revolving drum and three stationary blades. Material is held against the inside face of the drum by centrifugal force. An energy converter blade peels a stream of material off the drum face, creating an end-over-end mixing action. Two cross-mixing blades create a side-to-side mixing action. Asphalt is introduced into the drum by a Yale & Towne Tri-Rotor Pump at a maximum rate of 8 gal in 6 sec. The pump is controlled by an automatic timer which closes the hand-operated control valve when the desired gallonage has been introduced. This pump can also be used for unloading tank cars of asphalt.

The mixer is powered by a 12-hp gasoline engine or can be equipped with an electric motor. Overall height is 58 in., length 81 in., width 68 in. Approximate weight is 1500 lbs. Pneumatic tires are 6:00 × 16. An adjustable truck hitch is provided for transporting. Literature can be secured from the manufacturer.

New Type Material Handler

The SALSBURY TURRETEER, a new type material handler, is credited with substantially increasing production at the United Concrete Manufacturing Company plant in Roscoe, Calif. The Turreteer is designed and built at Salsbury Motors, Inc., a subsidiary of Northrop Aircraft, Inc., builders of the famed Flying Wing B-35 long-range bombers.

The Salsbury Turreteer has its power unit mounted in an encased turret which swivels like the revolving gunmount of a warplane. Direction of travel is altered by revolving the turret, a mechanical improvement which eliminates gears and transmissions. The drive wheel is combined with the power plant as a single unit. The gasoline tank is mounted in the hood of the turret.

Only three controls are necessary—throttle, steering turret and brake. The accelerator automatically engages the clutch and as the Turreteer gains speeds, the transmission shifts automatically into the most economical range to handle the load. It is equipped with a "deadman" type brake. Four widely spaced wheels give balance and stability to the load. Operation of the Turreteer is so simple that any one who can drive a car can operate it easily.

The Turreteer will operate continuously from ten to twelve hours on $3\frac{1}{2}$ gal. of gasoline, haul loads to 4,000 lb. at speeds as high as eight miles an hour with any standard skid.

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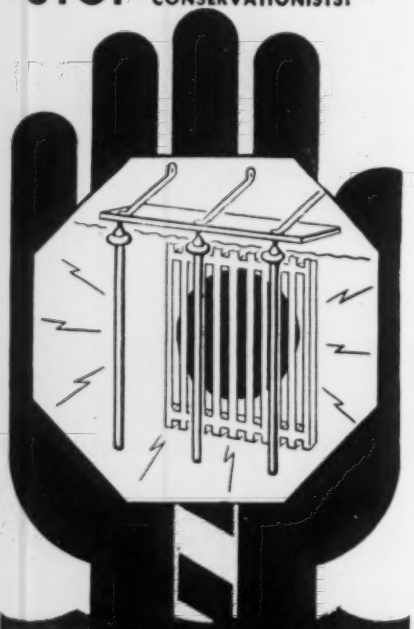

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Literature Available

PROTECTIVE COATING—Prufcoat Laboratories, Inc., announce a new catalog folder describing their line of Prufcoat Protective Coatings. This catalog lists features of Prufcoat, chemical agents Prufcoat resists, an interesting variety of actual case histories as well as Prufcoat uses and complete application information. It describes how Prufcoat gives positive protection against corrosion and lists specifications. Copies may be obtained by addressing Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.

NEW HORTONSPHERE BOOKLET—The Chicago Bridge and Iron Co., Chicago, Ill., announces the publication of a new 8-page booklet, "The Hortonsphere." It describes the reduction of evaporation losses from highly volatile liquid by storing them under pressure in Hortonspheres. The correct storage pressure required to prevent standing losses from volatile liquids can be read directly from the chart included in this booklet. There is also a chart for determining the vapor pressure of the product to be stored at a given temperature. Gaging methods are described and photographs of three typical gaging units are shown. A copy of the booklet will be sent on request.

PLANT-MIXED ASPHALT PAVEMENTS—Detailed descriptions of types of asphalt paving in which asphalt and aggregate are mixed in a plant are set forth in a booklet recently published by The Texas Co. This booklet covers the proper procedure and materials to be used in the construction of sheet asphalt, sand asphalt, and the various types of hot and cold-laid asphaltic concrete paving. Helpful information is furnished on the correct method of unloading asphalt from tankcars. Copy of the booklet may be obtained free by writing The Texas Co., Asphalt Sales Department, 135 E. 42nd St., New York 17, N.Y.

NEW PUMP CATALOG—An entirely new catalog of 180 pages is announced by The Deming Company of Salem, Ohio, manufacturers of an extensive line of pumps and water systems. The first 86 pages cover the industrial lines of pumps including numerous types of centrifugal pumps, sump pumps, cellar drainers, drainers, deep well turbine pumps, high pressure pumps, condensation return units, boiler feed pumps, mine pumps, Triplex pumps, "Turbo-Flo" pumps and rotary pumps. Balance of the catalog consists of 65 pages on the extensive lines of Deming Water Systems for domestic and farm use and 29 pages on pump accessories and spray pumps. Large sectional views and exterior views of each type of pump supplement detailed descriptions of construction and operation. Additional information includes performance tables, selection tables, and useful engineering information relating to various factors about pumps, water systems and related equipment. Several new lines of Deming Pumps are featured in the new book which is identified as "Catalog No. G-47." The Deming Company, Salem, Ohio.

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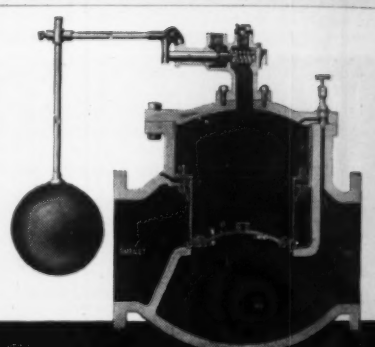

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